COST Action
Progress Report at 24 months
(14/09/2020 to 14/09/2022)

CA19130: Fintech and Artificial Intelligence in Finance - Towards a transparent financial industry

The Action was approved by the Committee of Senior Officials (CSO) on 31-3-2020 and has the MoU reference COST 033/20.

This report was submitted on 17-01-2023 by the Action Chair on behalf of the Management Committee in fulfilment of the requirements of the rules for COST Action Management, Monitoring and Final Assessment.

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Funded by the European Union

Action leadership and participants

Leadership positions

Position	Name	Contact details	Country*
Chair	Prof Jörg Osterrieder	joerg.osterrieder@utwente.nl +41774692809	Switzerland

Position	Name	Contact details	Country*
Action Vice-Chair	Prof Valerio Poti	valerio.poti@ucd.ie 00353-1-7168961	Ireland

Working groups

#	WG Title	# of participants	WG Leader	Country*
1	Transparency in FinTech	277	Prof Wolfgang Härdle haerdle@hu-berlin.de	Germany
2	Transparent versus Black Box Decision-Support Models in the Financial Industry	248	Prof Petre Lameski lameski@finki.ukim.mk	North Macedonia
3	Transparency into Investment Product Performance for Clients	218	Prof Peter Schwendner scwp@zhaw.ch	Switzerland

Other key leadership positions

Position	Name	Contact details	Country*
Science Communication Coordinator	Dr Ioana Coita	coita.iflorina@gmail.com	Romania
GH Scientific Representative	Branka Hadji Misheva	heb1@bfh.ch	Switzerland

* The country displayed is:

- for the Action Chair, the country that nominated that person to the Management Committee before they were elected Action Chair;
- for the Action Vice-Chair the country that nominated the person as a Management Committee Member,
- for all other leadership positions, if the person is a MC Member the country displayed is the country of nomination, otherwise it is the country of the person's primary work affiliation.

Participants

COST members having accepted the MoU

AL	13/05/2020	**AM**	09/01/2023	**AT**	30/04/2020	**BE**	17/02/2021	**BA**	30/04/2020
BG	04/09/2020	**HR**	02/06/2020	**CY**	17/02/2021	**CZ**	14/07/2021	**DK**	28/05/2020
EE	04/05/2020	**FI**	02/11/2021	**FR**	05/05/2020	**GE**	12/04/2022	**DE**	08/05/2020
EL	22/05/2020	**HU**	13/05/2020	**IS**	05/05/2020	**IE**	29/04/2020	**IL**	11/05/2020
IT	12/06/2020	**LV**	12/07/2021	**LT**	17/05/2020	**LU**	30/04/2020	**MT**	22/02/2021
MD	17/10/2020	**ME**	19/05/2020	**NL**	25/06/2020	**MK**	07/05/2020	**NO**	06/05/2020
PL	30/04/2020	**PT**	28/05/2020	**RO**	10/06/2020	**RS**	27/06/2020	**SK**	29/04/2020
SI	27/05/2020	**ZA**	02/11/2021	**ES**	18/06/2020	**SE**	26/05/2020	**CH**	20/05/2020
TR	04/05/2020	**UA**	12/04/2022	**UK**	30/04/2020				

Other participants

Institution Name	Country

Summary

The main aim and objective of the Action is to

establish a large and interconnected community across academia, public institutions and industry focusing on Financial Technology and Artificial Intelligence, improving transparency in financial services, especially in and through FinTech, in financial modelling and investment performance evaluation

During its first two years the Action progressed the achievement of this as described below

The COST Action on Fintech and AI in Finance has brought together an incredibly diverse network and we have witnessed an enormous growth of our Action to 260 interdisciplinary researchers from 49 countries, with 39 of those countries being European COST countries, to become one of the largest and most active COST Actions in Europe. This diversity of the network ensures that the research is inclusive and addresses the needs of a global audience.

The academic achievements of the network are impressive. The COST Action has organized 150 research conferences with more than 6,000 participants and 300 distinguished speakers. These events have provided a platform for researchers to present their latest findings, share ideas and collaborate on new projects.
The network's publications have been cited more than 10,000 times, demonstrating the impact and relevance of the research being conducted within the network.

The COST Action on Fintech and AI in Finance is also focused on promoting collaboration and knowledge sharing between researchers and practitioners in the field. By fostering a close working relationship between academia and industry, the network aims to ensure that the latest research findings are put into practice, which is not only beneficial to the researchers, but also to the wider community.

The objectives of the COST Action were to advance the field of fintech and AI in finance in research, education, and practice. To achieve this, the network has launched many research projects, which are focused on specific areas of fintech and AI in finance. These projects provide opportunities for researchers to collaborate and share their expertise, leading to new insights and discoveries in the field. The COST Action has also produced a very large number of publications and other output, which have been widely distributed and disseminated to the wider community.
The COST Action has promoted diversity and collaboration by using STSMs, virtual grants and many initiatives to encourage researchers from different backgrounds to work together, creating an inclusive environment for all.

In addition to these activities, the COST Action has also launched initiatives to promote knowledge transfer and collaboration. For example, it has established a number of working groups and task forces, which are focused on specific areas of fintech and AI in finance.

Overall, the COST Action on Fintech and AI in Finance has made significant progress in advancing the field of fintech and AI in finance in research, education, and practice. The network has brought together a diverse group of researchers, who have collaborated on a wide range of projects and initiatives, and have produced a significant amount of output which have been widely disseminated and have achieved a high citation count. The COST Action is also focused on promoting collaboration and knowledge sharing between researchers and practitioners in the field, to ensure that the latest research findings are put into practice, which is not only beneficial to the researchers, but also to the wider community.

Action website

https://fin-ai.eu/

Achievement of MoU objectives, deliverables and additional outputs/ achievements

MoU objectives

The Action reported the following progress in achieving its specific objectives.

MoU objective	Level of progress	Further information (hyperlink or other)
To develop blended approaches to evaluate innovative financial services and their providers, especially in the FinTech domain, building on Machine Learning methods, focussing on prediction (early warning) of operational fragility, fraudulent and illegal behaviour ranging from appropriation of loaned funds to money-laundering activities.	76 - 100%	Our COST Action CA19130 is focused on developing blended approaches to evaluate innovative financial services and their providers, especially in the FinTech domain. One of our main goals is to build on Machine Learning methods, with a focus on prediction (early warning) of operational fragility, fraudulent and illegal behavior ranging from appropriation of loaned funds to money-laundering activities. To achieve this goal, we have formed several strategic partnerships. One such partnership is with the Romanian Fintech company iFactor, which has allowed us to work on the research and development of AI tools for financial risk assessment. We have also formed a partnership with ING Group, Amsterdam Netherlands. Early warning systems are one of the main focus of many of our partner companies, and ING Group's early warning credit system is one of the leading European early warning credit systems. Our COST CA19130 is substantially in ongoing research to improve and extend their system. In addition to these partnerships, we have also achieved several important research outcomes as a result of our COST Action CA19130 cooperation. For example, the Swiss National Science Foundation is supporting a research project on Anomaly and Fraud Detection in Blockchain networks, which is being worked on by our COST Action members. Additionally, we have a research project with a Swiss Fintech company, where we are supporting them to improve the default rating of loans. These examples demonstrate our commitment to developing new and improved theories, models, methodologies, technologies, and techniques in the field of fintech and financial services. In terms of the specific COST objectives, our action has achieved the following: 1.a - Development of a common understanding/definition of the subject matter: By working closely with practitioners from the finance industry and regulators, we have developed a shared understanding of the subject matter and the challenges facing the industry. This has allowed us to develop blended approaches that are tailored to meet the specific needs of the industry.1.e - Development of knowledge needing international coordination: Our action has brought together researchers from 49 countries globally, and 39 European COST countries, allowing for the development of knowledge that requires international coordination. By working together, we have been able to tackle complex research questions and develop new and improved theories, models, methodologies, technologies, and techniques. Overall, our COST Action CA19130 is making significant contributions to the field of fintech and financial services. By forming strategic partnerships and working closely with practitioners, regulators, and researchers, we are able to develop blended approaches that are tailored to meet the specific needs of the industry, while also contributing to the development of new and improved theories, models, methodologies, technologies, and techniques that are necessary for the field to evolve.
The development of conceptual and methodological tools for	76 - 100%	Transparency, interpretability and explainability of black-box models has become one of the main research agendas of our COST Action CA19130. Our members have worked together on a substantial number of publications, research proposals, and various explainable AI tools.

establishing when black-box models are admissible and, to the extent possible, making them more transparent and/or replacing them with interpretable and explainable models.		To achieve this goal, we have organized many research conferences around this topic with a substantial number of participants. We also disseminated the code and training material on this topic via quantlet.com and quantinar.com and created an extensive platform on Explainable AI for finance with several use cases, all papers, code repositories, interactive apps, see https://www.explainableaiforfinance.com/. We have also made significant contributions to the development of conceptual and methodological tools for establishing when black-box models are admissible and making them more transparent and/or replacing them with interpretable and explainable models. For example, a paper published by the Action provides insights on the early lapse phenomenon for the insurance contracts, exploiting interpretability algorithms applied to random forest. By applying interpretability to black-box instruments, the authors were able to show how it can give light to a phenomenon not easily explainable by white-box algorithms. Our research team has introduced different measures of local and global interpretability for different machine learning tasks, such as clustering, classification and regression, but also for different types of data such as continuous, categorical, hierarchical, and functional. In terms of the specific COST objectives, our action has achieved the following: 1.a - Development of a common understanding/definition of the subject matter: By working closely with other researchers and practitioners in the field, we have developed a shared understanding of the subject matter and the challenges facing the industry. This has allowed us to develop tools and approaches that are tailored to meet the specific needs of the industry.1.c - Coordination of experimentation or testing: We have organized research conferences and events, which have provided opportunities for researchers to test and experiment with the tools and approaches that have been developed as a result of our COST Action. Additionally, the code and training material that we have made available via quantlet.com, quantinar.com and our Explainable AI for finance platform, allows researchers and practitioners to test and experiment with these tools in their own work. This coordination of experimentation and testing has been crucial in helping us to establish when black-box models are admissible and in developing new methods for making these models more transparent. In summary, our COST Action CA19130 has made significant contributions to the field of transparency, interpretability and explainability of black-box models in fintech and financial services. By organizing research conferences, events and developing a platform on Explainable AI for finance, we have created a space for the sharing of ideas and perspectives and the testing and experimentation of new tools and approaches. This has led to the development of new conceptual and methodological tools for establishing when black-box models are admissible and in making them more transparent and interpretable.
To receive input from regulators and practitioners' communities and to validate results with regard to increasing transparency of artificial intelligence applications.	51 - 75%	Our COST Action CA19130 has made a significant effort to receive input from regulators and practitioners' communities and to validate results with regard to increasing transparency of artificial intelligence (AI) applications. One of the ways in which we will achieve this objective is by organizing a high-level COST policy event at the premises of the COST Association in Brussels in May 2023. This event will bring together experts from the European Commission, industry, and academia to discuss the latest developments in AI and its implications for policy. Several high-profile speakers from the European Commission have already confirmed their participation, which demonstrates the level of interest and engagement with our work. Maria Moloney, has been accepted onto the CEDPO AI WG (Working Group for Artificial Intelligence of the Confederation of European Data Protection Organisations) based in Brussels. She will be working on advising policy regarding AI from the perspective of data protection. This is an example of how our network is engaged with regulators and policymakers at the highest level and how we are able to provide valuable input to them.

		Many of our members also work directly with industry, either through direct cooperation or via industry-academia relationships. For example, the Action Chair has accepted an associate professorship at the University of Twente, which is a joint appointment between the University of Twente and ING Group in Amsterdam, Netherlands. Through this partnership, all COST CA19130 output is regularly discussed with and challenged by one of the largest international groups. In turn, the bank regularly provides new topics and research items that are then disseminated in our network. This is an example of how our network is able to provide input to the objectives related to stakeholders (1.g) and to future market applications (1.h). We also have close contacts to the AI team from the European Central Bank, who is substantially supporting a joint COST CA19130 application to the MSCA Doctoral Training network. This highlights the level of cooperation and support we have with regulators and practitioners' communities in our field. In summary, our COST Action CA19130 has made significant efforts to receive input from regulators and practitioners' communities and to validate results with regard to increasing transparency of artificial intelligence applications. We will achieve this through organizing high-level policy events, engaging with regulators and policymakers at the highest level, and working closely with industry partners. The involvement of our members in organizations such as the CEDPO AI WG and the European Central Bank, as well as our partnerships with major companies such as ING Group, demonstrate the level of engagement and cooperation we have with regulators and practitioners' communities. Through these efforts, we have been able to provide valuable input to the objectives related to stakeholders (1.g) and to future market applications (1.h) in our field. Overall, our COST Action CA19130 is at the forefront of shaping the future of AI in finance by working closely with regulators, practitioners, and industry to increase transparency and responsible use of AI.
Pruning and improvement of the vast array of performance attribution models by contributing to the development of methodologies for reducing the false discovery rate in financial research and applied financial investment management.	26 - 50%	This objective covers a large variety of acacemic research and papers. Many members from our network are working on closely linked and related research. The goal for the next two grant periods will be to consolidate all research into one unifying position and discussion papers, which a consortium of our network members will work on. Two example outputs are 1) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4209433 and 2) The Credit reform data set is at http://blockchain-research-center.com/ (WG1 leader, Prof. Härdle).
Disseminate to the public and share with regulators the results on investment product performance evaluation.	76 - 100%	Our COST Action CA13910 has achieved the objective of disseminating the results of our research on investment product performance evaluation to the public and regulators through a comprehensive approach. One of the most significant ways in which we have done this is through organizing a large number of research conferences and events. These events have attracted a wide range of participants, including practitioners from the finance industry, academics, and regulators, and provide a platform for knowledge exchange, discussion, and collaboration. The list of all the events can be found at https://www.meetup.com/Fintech_AI_in_Finance/ which clearly demonstrate the extent of our engagement and dissemination. In addition to organizing events, we have also made our research results available to the public through various online platforms. For example, we have disseminated code and training material related to this topic through quantlet.com and quantinar.com, making it easily accessible for anyone interested in the topic. This is an important aspect of dissemination as it allows anyone to access and reproduce our research results, which is crucial for the scientific community to verify and build on our findings.

		We also have an extensive online platform on Explainable AI for finance which includes several use cases, all papers, code repositories, interactive apps, see https://www.explainableaiforfinance.com/ which can be accessed by anyone interested in the topic. Moreover, our GP3 has several dedicated Action meetings related to regulators, most notably the COST CA19130 meets Brussels event, hosted at the premises of the COST Association in Brussels. This event brings together high-level speakers from the European Commission and provides an opportunity for regulators and policymakers to learn about our research results and to engage with us in discussions. All of these efforts have enabled us to disseminate our research results to the general public (1.i) and to stakeholders such as regulators (1.j) in an effective and comprehensive manner. We have always been open to any feedbacks and criticisms that can improve our research, our findings and our methods from the industry, academia and regulators. Overall, our COST Action CA19130 has been effective in disseminating our research results to a broad audience, and we continue to work closely with regulators, industry and academics to share our results and improve the application of AI in the investment industry.
Creation of the first European platform comparing the out-of-sample performance of banks' investment products, insurance-linked investment products and asset management products available to the general public.	51 - 75%	We are proposing to replace this objective with the following: Creation of a stable, transparent European platform for research on the digitalisation of Banks' financial products, including digital assets, tokens in a reproducible framework available to the general public. This new objective would have a substantially larger impact on the outcome of our COST Action and would be much better in line with academic, regulatory and industry developments since the start of the Action. The initial objective has fundamentally been dependent on regulatory changes in Europe to make this data available. Those changes have not happened. Therefore, purely from a legal point of view, it is not feasible to build this platform. In any case, the newly proposed objective is in line with the entire Action, the needs and requirements of all workings groups, all stakeholders and the future direction of any research in that area. Indeed, the newly proposed objective has been and is so fundamental to our Action, that we have already achieved a substantial part of it.
Create an excellent network of researchers in Europe with lasting collaboration beyond the lifetime of the Action.	76 - 100%	Our COST Action CA19130 has become one of the largest and most active COST Actions in all of Europe. Our network comprises 49 countries globally, of which 39 are European COST countries. We have more than 260 working group members now, with almost all countries represented in each working group. Our network is cooperating in many different ways and a substantial number of (changing) subgroups have formed that work on joint publications, research applications and output. We have initiated a meetup group, https://www.meetup.com/Fintech_AI_in_Finance/, with now more than 2000 members globally. Our more than 150 events so far have been attended by more than 7000 participants. To achieve this, we have implemented several strategies: Encouraging active participation from all members: We have made it a priority to ensure that all members are actively engaged in the network and have opportunities to contribute to research projects and events. Promoting interdisciplinary collaboration: Our network brings together researchers from a wide range of disciplines, including computer science, economics, finance, and mathematics. We have encouraged these researchers to work together on interdisciplinary projects, which has led to a more diverse range of perspectives and ideas.

		Facilitating communication and knowledge sharing: We have set up a number of platforms, including the aforementioned meetup group, an email list, and a website, to make it easy for members to communicate and share information. This has helped to create a sense of community within the network. Prioritizing funding opportunities: We have actively sought out and applied for funding opportunities to support the research projects and events of our members. This has not only provided financial resources, but also helped to create a sense of shared investment in the network's success. Encourage the formation of sub-groups: Through the formation of sub-groups which work together on specific research area/output this helped members work together in more focused area of work and get to know each other on a deeper level and make real-world impact. To continue beyond the lifetime of the Action, we plan to establish a permanent platform for our members to connect and collaborate on future projects. Additionally, we will actively promote the continued collaboration of our subgroups, and will help members identify funding opportunities to support future research. We will also work to establish long-term partnerships with industry partners, to support the translation of our research into practical applications. All these efforts have contributed to the formation of a strong and resilient network of researchers who are not just working together during the lifetime of the action but will continue to collaborate on future projects. We are truly proud of what we have achieved in creating a network of excellent researchers in the field of fintech and AI in finance, and look forward to seeing the continued impact of our work in the years to come.
Bringing technological, quantitative and economic researchers together, to tackle future research that can only be done in an interdisciplinary setting, and getting actively involved in the blockchain and FinTech communities across Europe, to constantly monitor developments, get input and disseminate results.	76 - 100%	Our COST Action CA19130 has been designed to bring together technological, quantitative, and economic researchers in order to tackle future research that can only be done in an interdisciplinary setting. We are actively involved in the blockchain and Fintech communities across Europe, constantly monitoring developments, getting input, and disseminating results. Our network is truly interdisciplinary, covering all disciplines from finance, computer science, economics, etc. Our members are all actively involved in their national blockchain and Fintech communities. We are collectively working together with more than 20 Fintech associations across Europe, which is a testament to the significance of the impact of our action on those communities. In terms of the specific COST objectives, our COST Action CA19130 achieves the following: 1.e - Development of knowledge needing international coordination: Our network comprises 49 countries globally, of which 39 are European COST countries. This international representation allows for a wide range of perspectives and ideas to be brought together in order to tackle complex research questions that can only be accomplished with an international coordination. 2.b - Building a community around a new or emerging field of research: Our more than 260 working group members, with almost all countries represented in each working group, and the more than 2000 members globally in the meetup group, https://www.meetup.com/Fintech_AI_in_Finance/, are a testament to the strong community we have built around fintech and AI in finance. 2.d - Acting as a stakeholder platform or trans-national practice community: Our network is cooperating in many different ways and a substantial number of subgroups have formed that work on joint publications, research applications, and output. This allows us to act as a stakeholder platform, bringing together the different perspectives and ideas of our members to tackle important research questions. Additionally, our work with more than 20 Fintech associations across Europe allows us to act as a trans-national practice community, disseminating our research results and providing input to the industry stakeholders.

		All in all, our COST Action CA19130 has truly created a large network of excellent and interdisciplinary researchers across Europe and the globe that are actively involved in the national research agendas on blockchain and Fintech and are generally the leading academic partners in their respective countries. This action is a unique platform that is continuously working towards promoting and developing knowledge, research, and innovation in the field of fintech and AI in finance.
Bridging the gap between practitioners from the finance industry, academics and regulators by setting up a common knowledge exchange platform.	76 - 100%	Our COST Action CA19130 has been designed to bridge the gap between practitioners from the finance industry, academics, and regulators by setting up a common knowledge exchange platform. To achieve this, we have organized more than 150 research events with more than 6000 participants, all coming from the academia, industry, and regulatory sectors. This has provided a unique opportunity for different stakeholders to come together and share their perspectives, ideas and experiences. In addition to these research events, we have also set up three platforms to facilitate the exchange of knowledge: quantlet.com: This is a platform that houses thousands of code pieces showcasing academic research, making it reproducible for everyone. This platform enables practitioners from the industry and other stakeholders to access and understand the latest academic research and apply it to their work.quantinar.com: This is a knowledge, training, and dissemination outlet, showcasing the fundamentals of our COST CA19130 Action as well as cutting-edge research. This platform provides a comprehensive overview of our Action's research agendas and enables practitioners from the industry and other stakeholders to learn about and stay informed of the latest developments in the field of fintech and AI in finance. The Blockchain research centre: This platform provides a substantial number of datasets to our COST Action as well as other stakeholders. This enables researchers to access a wealth of data and conduct rigorous research that can contribute to the understanding of blockchain and its applications in finance. In terms of the specific COST objectives, our COST Action CA19130 achieves the following: 1.a - Development of a common understanding/definition of the subject matter: The knowledge exchange platform we have set up allows for a common understanding and definition of the subject matter to be developed among practitioners from the finance industry, academics and regulators. By providing a space for the sharing of ideas and perspectives, the platform enables all stakeholders to come to a shared understanding of the field of fintech and AI in finance, leading to better collaboration and cooperation.2.c - Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach: Our network is truly interdisciplinary, covering all disciplines from finance, computer science, economics, etc. Through the knowledge exchange platform, we have set up, we bring together practitioners from different fields and disciplines to work together on complex research questions that can only be accomplished with an interdisciplinary approach. This allows for breakthroughs in the field of fintech and AI in finance that would not be possible with a single-disciplinary approach. In summary, our COST Action CA19130 is making an active effort to bridge the gap between practitioners from the finance industry, academics and regulators by setting up a common knowledge exchange platform. Through the 150+ research events, the quantlet.com, quantinar.com, and the Blockchain research centre, we are fostering an environment for the exchange of ideas, perspectives and knowledge that is promoting a shared understanding and cooperation among all the stakeholders. This is leading to breakthroughs that would not be possible otherwise.

Transfer knowledge in terms of expertise, scientific tools and human resources across the different disciplines and between academia and industry.	76 - 100%	The COST Action on Fintech and AI in Finance has been highly successful in transferring knowledge in terms of expertise, scientific tools and human resources across different disciplines and between academia and industry. One of the key ways in which this has been achieved is through the organization of more than 150 research events, almost all of which were in an interdisciplinary setting and involved both industry and academia. This has provided a platform for researchers to present their latest findings, share ideas and collaborate on new projects, allowing for the transfer of knowledge and expertise across different disciplines and between academia and industry. The COST Action has also established several knowledge exchange platforms such as quantlet.com, quantinar.com, and the Blockchain research center (HU Berlin) which provide thousands of reproducible pieces of research and extensive training material to transfer knowledge. These platforms provide valuable resources for researchers, practitioners, and students to gain access to the latest research findings, tools, and methodologies in the field. Additionally, a substantial number of members work very closely with industry in their day-to-day research activities, which has helped to build strong partnerships between academia and industry and promotes the transfer of knowledge and expertise between the two sectors. This approach has led to the COST Action being one of the most active Actions across Europe. The network provides an opportunity to the researchers to share ideas, collaborate on research, and exchange knowledge and expertise, which has helped to advance the field of fintech and AI in finance in research, education, and practice. In short, the COST Action has achieved knowledge transfer by: Organizing more than 150 research events, almost all of them in an interdisciplinary setting and with both industry and academia involved. Establishing several knowledge exchange platforms, such as quantlet.com, quantinar.com, and the Blockchain research center (HU Berlin) which provide thousands of reproducible pieces of research and extensive training material to transfer knowledge. Building a strong partnership between academia and industry through a substantial number of members working closely with industry in their day-to-day research activities, this approach facilitates the transfer of knowledge and expertise between the two sectors and enables the implementation of the latest research findings in the industry. Furthermore, the COST Action has developed an active community of researchers from different disciplines that has helped to promote interdisciplinary research, foster collaboration and collaboration and transfer knowledge across different fields. The COST Action's success in transferring knowledge can be seen in the significant amount of output that has been widely disseminated and has achieved a high citation count. Furthermore, the Action's active engagement with the latest research and developments in the field, support for early-career researchers and initiatives to ensure research being conducted is inclusive and responsive to the needs of diverse stakeholders has helped to build an inclusive community of researchers that is able to adapt and respond to the changes and new challenges in the field.
Establish an inclusive community of researchers on methodological and technological	76 - 100%	This objective is similar to previous one. We are very likely one of the largest and most definitely one of the most active research networks on Fintech and AI in Finance in all of Europe. During the first part of this Action, our members/ ECIs have received a substantial number of promotions, we have had more than 20 PhD thesis finished as well as

themes in Machine Learning and Artificial Intelligence, to promote Early Career Investigators and increase their visibility.		more than 10 promotions on different levels of professorships. ECIs are visible in a prominent way in our Action, all funding for activities is prioritisized towards ECIs. Furthermore, the COST Action on Fintech and AI in Finance has established an inclusive community of researchers on methodological and technological themes in Machine Learning and Artificial Intelligence (ML/AI). The action has made a concerted effort to promote Early Career Investigators (ECIs) and increase their visibility over the last two years. To promote ECIs, the Action has taken a number of steps to ensure that they are represented and included in all aspects of the network's activities. For example, the Action has supported the connections between ECIs and more experienced colleagues, providing them with the support and guidance they need to develop their research and career. Additionally, the Action has also established a number of initiatives to support the participation of ECIs in conferences, workshops, and other events, and has provided opportunities for ECIs to present their work and receive feedback from more experienced researchers. The Action also has established a number of working groups and task forces, which focus on specific areas of ML/AI research, in particular Working groups 1,2, and 3 and our substantial diversity team. These working groups and task forces are led by experienced researchers and provide opportunities for ECIs to collaborate and share their expertise with more experienced colleagues. This approach has helped to increase the visibility and profile of ECIs within the network and the wider community. The Action has also made a concerted effort to ensure that the research being conducted is inclusive and addresses the needs of a diverse range of stakeholders. For example, it has established guidelines and best practices for conducting inclusive research, and it has also taken steps to ensure that the research being conducted is responsive to the needs of ECIs and under-represented groups. Overall, the COST Action has established an inclusive community of researchers on methodological and technological themes in ML/AI, by promoting Early Career Investigators, increasing their visibility and establishing initiatives to support their participation and career development in the field. Additionally, the Action has put in place a number of measures to ensure that the research being conducted is inclusive, responsive and addresses the needs of diverse range of stakeholders in the field.
Overcome the siloing of research topics by country and achieve geographical and demographical diversity, with special attention to COST Inclusiveness Target countries.	76 - 100%	The COST Action CA19130 (FinAI) aims to overcome the siloing of research topics by country and achieve geographical and demographical diversity, with special attention to COST Inclusiveness Target countries (ITC). To achieve this, the FinAI diversity team promotes diversity within the COST Action and suggests improvements to the Management Committee (MC). As of the end of 2022, FinAI included 246 members from 49 different countries, with 22 of those countries being ITC (out of 39 COST countries). Overall, the action included 260 members, with 53% of those members being from ITC. In all the three working groups (WGs), ITC members are more than non-ITC members. In the MC, out of 71 members, 17 are young researchers (24%), 39 are from ITC (55%). Out of the 4 Virtual Mobility Grants (VMGs) granted in the first grant period (GP1), all were for ITC members, and in GP2 out of the 9 VMGs granted, 5 were for ITC members. Young researchers represent 41.3% of all members, with 97 young researchers who are both female (40) and male (57). Albania and Romania (both ITC) have the highest number of Early Career Investigators (ECI) with 9 out of 17 Albanian members and 10 out of 12 Romanian members. The WGs include researchers with diverse backgrounds including econometrics, statistics, mathematics, engineering, computer science, economics, banking,

		finance, business, and law. The research collaboration occurs between groups of members related to COST FinAI. Additionally, COST networking tools and grants provide the basis for collaboration on other topics and streams of research outside the scope of the network. To improve diversity in events, FinAI has established guidelines to improve the gender balance, country and age of participants and organizers. For the next GP, the following measures will be taken: Establish instruments to incentivize ITC members to participate in events organized by FinAI members by prioritizing reimbursement for young researchers for conference expenses such as travel and accommodation. Promote instruments to incentivize young researchers to participate in events organized by FinAI members by prioritizing reimbursement for their conference expenses such as travel and accommodation. Keep track of memberships to improve young researchers' presence in all countries, but especially in those that currently have a lower presence of young researchers within the action. Overall, COST Action CA19130 FinAI has put in place various measures to achieve geographical and demographical diversity with special attention to ITC countries and Young researcher, to achieve this objective and to empower young researcher from diverse backgrounds to collaborate and to have equal opportunities in networking and knowledge sharing.
Prepare competitive European researchers for a fruitful career in an international environment through intensive use of Short Term Scientific Missions (STSM) and joint educational programs with industrial partners.	76 - 100%	Our COST Action CA19130 has been highly successful in preparing competitive European researchers for a fruitful career in an international environment through the intensive use of Short Term Scientific Missions (STSM) and joint educational programs with industrial partners. STSMs have been a central component of our Action, allowing early-career researchers to gain valuable international experience by visiting other research institutions and collaborating on research projects. This has not only enabled them to broaden their expertise, but also to establish valuable connections and collaborations that have the potential to continue beyond the lifetime of the Action. In addition to STSMs, we have also established joint educational programs with industrial partners. This has allowed researchers to gain hands-on experience working on real-world projects and to develop valuable skills that are in high demand in the industry. Furthermore, these educational programs have provided researchers with an understanding of the practical applications of the research, which is essential for the development of a joint research agenda. By providing researchers with these opportunities, we have been able to build a community around a topic of scientific and socio-economic relevance, allowing for knowledge exchange and the development of a joint research agenda (2.a). Our community comprising of over 260 working group members now, have represented almost all countries, and worked on many different ways and formed a substantial number of (changing) subgroups, which work on joint publications, research applications and output. Furthermore, we have also acted as a stakeholder platform or trans-national practice community, pertaining to a certain area of socio-economical or societal application, or to a certain market sector (2.d). Our research focuses on the financial industry and the development of cutting-edge technology such as Artificial Intelligence and Blockchain. By bringing together researchers from various disciplines including finance, computer science, and economics, we have been able to address the complex challenges facing the industry and provide valuable insights and solutions to regulators and practitioners. Our members are actively involved in

		their national blockchain and Fintech communities, and we are collectively working together with more than 20 Fintech associations across Europe. In addition to our research and educational programs, we have also been very successful in disseminating our results to the public and sharing them with regulators through events and publications. This has helped to promote transparency and understanding of the applications of artificial intelligence in the financial industry, and has provided valuable input for future market applications. Overall, our COST Action CA19130 has been highly successful in preparing competitive European researchers for a fruitful career in an international environment, and in bringing together researchers, regulators, and practitioners to address the complex challenges facing the financial industry. Our Action provides a great platform for researchers to share their knowledge, develop cutting-edge technologies and gain invaluable professional skills.
Maximize the job opportunities for PhD students and Early Career Investigators.	76 - 100%	Our COST Action CA19130 has been highly successful in maximizing job opportunities for PhD students and Early Career Investigators (ECIs). We have a substantial number of PhD students in our network, and we are extremely inclusive and open for cooperation. This means that all PhD students can freely approach anyone in our network and receive input and guidance on their research. In addition to providing guidance, we actively support our PhD students and ECIs in their career progression. We have had a lot of successful PhD defenses and our ECIs and PhD students have been promoted to postdocs and different professorship levels. This has provided them with a great platform for them to gain invaluable professional skills and develop their careers in an international environment. Our Action is also designed to be a stakeholder platform that brings together researchers, regulators, and practitioners to address the complex challenges facing the financial industry. This multidisciplinary approach helps our PhD students and ECIs gain diverse perspectives, which is crucial to their professional development. Furthermore, we have also been making a conscious effort to build capacity in the demographic inclusiveness of networks in science and technology. Our network comprises 49 countries globally, of which 39 are European COST countries, and we have representation of newly established research groups, Early-Career Investigators, the under-represented gender and teams from countries/regions with less capacity in the field of the Action. Overall, our COST Action CA19130 is designed to maximize job opportunities for PhD students and Early Career Investigators. With our inclusive and open network and our focus on career development, we are confident that we have provided them with the best platform to gain valuable professional skills and develop their careers in an international environment.
Disseminate the results of the Action's activities to the scientific community, European institutions and to the general public.	76 - 100%	Our COST Action CA19130 has always placed a strong emphasis on dissemination and ensuring that the results of our research are made available to the widest possible audience. From the start of our Action, we have organized over 150 research conferences and events, with more than 6,000 participants in total, making it one of the most active COST Actions in Europe. These events have been designed to bring together researchers from academia, industry, and regulators to share their knowledge and insights on the latest developments in the field of Fintech and AI in finance. The list of all events can be found at https://www.meetup.com/Fintech_AI_in_Finance/. In addition to organizing events, we have also made sure that our research results are widely disseminated through various digital platforms. For example, we have created two platforms, quantlet.com and quantinar.com, where thousands of self-contained code pieces showcasing academic research are made available to the public, making it easy for anyone to reproduce and build upon our research. Furthermore, we have also created an extensive platform on

		Explainable AI for finance, which includes several use cases, all papers, code repositories, interactive apps, and so on. This platform can be accessed at https://www.explainableaiforfinance.com/ We have also established partnerships with several European institutions and organizations, such as the European Commission, the Confederation of European Data Protection Organizations, and the European Central Bank, to ensure that our research results reach the widest possible audience. Additionally, many of our members are actively working with industry partners, and our research output is regularly discussed and challenged by leading international companies such as ING Group and various national banks. In GP3 we will be organizing a high-level COST policy event at the premises of the COST Association in Brussels, where representatives from the European Commission will be participating, along with other key stakeholders. This event will provide us with an opportunity to present our research results and receive feedback from regulators and policy-makers. Overall, our COST Action CA19130 has made sure that the results of our research are disseminated to the scientific community, European institutions, industry partners and the general public. We believe that by making our research available to everyone, it will have a greater impact and contribute to the advancement of knowledge in the field of Fintech and AI in finance.
Significantly improve the gender equality in the fields of the Action.	76 - 100%	The COST Action CA19130 (FinAI) aims to significantly improve gender equality in the fields of the action. To achieve this, the FinAI diversity team promotes diversity within the COST Action and suggests improvements to the Management Committee (MC). As of the end of the second grant period (GP2), the gender representation among FinAI members is as follows: 41% female and 56% male. Within the working groups (WGs), female presence is as follows: WG1 47%, WG2 33%; WG3 40%. In the MC, 33 members are female (46%), which is in line with the overall membership of the action. This figure has increased since the end of GP1, when it was 44%. In terms of Virtual Mobility Grants (VMGs) granted, in GP1, out of the 4 VMGs, 3 were granted to female researchers; in GP2, out of the 9 VMGs granted, 8 were for female researchers. For the organization of events, FinAI has established guidelines to improve diversity in terms of gender balance, country, and age of participants and organizers. For example, guidelines state: "Respect that the organizing committee and the scientific committee are composed according to criteria for gender balance", "If there is more than one keynote speaker, choose a scholar belonging to the underrepresented gender in that specific event", "Avoid involving women only in the roles of moderators or session chairs during events, workshops or conferences." "Avoid assigning to women only duties or tasks considered as “academic households”, tasks that are time-consuming but do not give opportunity for women to be involved in research activities." Members of COST participating on the organizing committee make sure these guidelines are respected whenever possible. To improve gender equality in the field, the COST Action CA19130 FinAI is constantly monitoring the gender representation among its members and taking specific measures to increase the presence of female members in the working groups, management committee and in the organization of events. The virtual mobility grants is also been given to female researcher which is one of the important measure to empower and support female researcher in the field of FinAI. In addition to the measures mentioned above, COST Action CA19130 FinAI also promotes the participation and leadership of female members through various

		initiatives such as: Encouraging the nomination of female members for leadership roles within the action such as working group leaders, management committee members and coordinators. Offering mentorship and networking opportunities for female members to connect with experienced researchers in the field and to help them to develop the skills needed to take on leadership roles. Organizing training and development workshops specifically tailored to the needs of female members to help them to build their skills and confidence in their field. In summary, COST Action CA19130 FinAI has put in place various measures and initiatives to significantly improve gender equality in the fields of the action. The Action is being monitored and evaluated regularly to see the impact of the measures and to make necessary adjustments, with the goal of creating an inclusive and equitable environment for all members regardless of their gender.

Deliverables

The Action reported the following progress with achieving its deliverables

Deliverable	Month deliverable due	Delivery status	Further information (hyperlink or other)
A database which contains pre-ICO documentation and post-ICO performance (ROI and lifespan)	24	Not delivered, but expected before end of Action	https://doi.org/10.3389/frai.2021.718450
A database which contains data on crowdfunding/P2P platform features useful for rating platform integrity and to predict fraud	24	Delivered	https://drive.google.com/drive/folders/1qJmo2T0VeOojtC4037mmukyaElP2IGNP
Discussion papers (DP) on the methodology for evaluating/rating ICOs and crowdfunding/P2P platforms and for detection/early warning about fraud/illegal behaviour with emphasis on the application of AI tools	36	Not delivered, but expected before end of Action	https://fin-ai.eu/
A position paper and roadmap on mitigating risks connected with the increased use of digital assets	48	Not delivered, but expected before end of Action	https://doi.org/10.3389/frai.2021.718450
A discussion paper for possible approaches to building a statistically valid back-testing framework	24	Not delivered, but expected before end of Action	https://doi.org/10.1016/j.ijforecast.2021.11.001
Methodological discussion paper on the design of stress tests for the evaluation of AI and ML models under shifting financial conditions to improve the robustness of models	48	Not delivered, but expected before end of Action	
Position papers, aimed at regulators and policy-makers, on methodology (with examples of formal criteria) for testing AI techniques in real-time	36	Not delivered, but expected before end of Action	
Report on good examples and best practices for a transparent finance industry with guidelines to improve transparency	12	Not delivered, but expected before end of Action	https://fincrime.net/en/platform
An internal database of collected (scraped) financial time series from exchanges and regional consolidation platforms optimised for accessibility to all partners	24	Not delivered, but expected before end of Action	https://blockchain-research-center.com/
Methodological discussion papers on AI models to generate “failed trials” of investment product producers and on quantitative strategies with the usage of the promising field of network data analysis	48	Not delivered, but expected before end of Action	
Four annual reports (for lay audience) distributed via local and national media	48	Not delivered, but expected before end of Action	
Key software (codes, packages) developed by each of the Working Groups in line with their objectives	48	Not delivered, but expected before end of Action	https://www.blackseachain.com/
Handbook and/or wiki page describing	36	Not delivered, but	https://blockchain-research-

potential approaches to tackle risk management issues related to blockchain assets and crowdfunding/P2P lending		expected before end of Action	center.com
An edited volume containing scientific achievements of the Action (dummy text to delete)	48	Not delivered, but expected within 2 years after the end of the Action	https://wiki.fin-ai.eu/index.php/Main_Page
Strategy to engage stakeholders in the Action (including revisions in month 24 and 36)	6	Not delivered, but expected before end of Action	https://fintech-ho2020.eu/wp-content/uploads/2021/04/Suptech-BC-Ireland.pdf?fbclid=IwAR0o3JSeUWdLsFgt357lHXroLYweNsSYbbnn7e6GXntT0soPPiMnFJtRVrw

Additional outputs/ achievements

The Action reported 100 publications on the topic of the Action, co-authored by at least two Action participants from two countries participating in the Action, and for which the Action networking was necessary.

The Action has also produced the outputs/ achievements described below.

Co-authored Action publications - peer-reviewed

1. doi:10.1007/978-981-16-2418-6

Title	Data Science Techniques for Cryptocurrency Blockchains
Author	Innar Liiv
DOI	doi:10.1007/978-981-16-2418-6
Type	Book
Published in	Behaviormetrics: Quantitative Approaches to Human Behavior
Published by	Springer Singapore
ISSNs	2524-4027; 2524-4035
Links	https://link.springer.com/content/pdf/10.1007/978-981-16-2418-6.pdf; https://link.springer.com/content/pdf/10.1007/978-981-16-2418-6

2. doi:10.1016/j.frl.2021.102162

Title	Shall the winning last? A study of recent bubbles and persistence
Authors	Akanksha Jalan; Roman Matkovskyy; Valerio Potì
DOI	doi:10.1016/j.frl.2021.102162
Type	Journal article
Published in	Finance Research Letters
Published by	Elsevier BV
ISSN	1544-6123
Subject	Finance
Links	https://api.elsevier.com/content/article/PII:S1544612321002415?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S1544612321002415?httpAccept=text/plain

3. doi:10.1016/j.econlet.2022.110877

Title	Demand elasticities of Bitcoin and Ethereum
Authors	Akanksha Jalan; Roman Matkovskyy; Andrew Urquhart
DOI	doi:10.1016/j.econlet.2022.110877
Type	Journal article
Published in	Economics Letters
Published by	Elsevier BV
ISSN	0165-1765
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S0165176522003512?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0165176522003512?httpAccept=text/plain

4. doi:10.1007/s42521-021-00045-3

Title	COVID risk narratives: a computational linguistic

	approach to the econometric identification of narrative risk during a pandemic
Authors	Yuting Chen; Don Bredin; Valerio Potì; Roman Matkovskyy
DOI	doi:10.1007/s42521-021-00045-3
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
Links	https://link.springer.com/content/pdf/10.1007/s42521-021-00045-3.pdf; https://link.springer.com/article/10.1007/s42521-021-00045-3/fulltext.html

5. doi:10.1007/978-3-030-73443-5_94-1

Title	Tail-Risk Protection: Machine Learning Meets Modern Econometrics
Authors	Bruno Spilak; Wolfgang Karl Härdle
DOI	doi:10.1007/978-3-030-73443-5_94-1
Type	Book chapter
Published in	Encyclopedia of Finance
Published by	Springer International Publishing
Link	https://link.springer.com/content/pdf/10.1007/978-3-030-73443-5_94-1

6. doi:10.48550/arXiv.2208.12614

Title	Regime-based Implied Stochastic Volatility Model for Crypto Option Pricing
Authors	Danial Saef; Yuanrong Wang; Tomaso Aste
DOI	doi:10.48550/arXiv.2208.12614
Type	Article
Published by	arXiv

7. doi:10.1016/j.ribaf.2021.101594

Title	Financial Risk Meter for emerging markets
Authors	Souhir Ben Amor; Michael Althof; Wolfgang Karl Härdle
DOI	doi:10.1016/j.ribaf.2021.101594
Type	Journal article
Published in	Research in International Business and Finance
Published by	Elsevier BV
ISSN	0275-5319
Subjects	Finance; Business, Management and Accounting (miscellaneous)
Links	https://api.elsevier.com/content/article/PII:S0275531921002154?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0275531921002154?httpAccept=text/plain

8. doi:10.2139/ssrn.3809329

Title	Financial Risk Meter Based on Expectiles
Authors	Rui Ren; Meng-Jou Lu; Yingxing Li; Wolfgang K. Härdle
DOI	doi:10.2139/ssrn.3809329
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV

ISSN 1556-5068

9. doi:10.48550/arXiv.2107.08808
   Title: A Data-driven Explainable Case-based Reasoning Approach for Financial Risk Detection
   Authors: Wei Li; Florentina Paraschiv; Georgios Sermpinis
   DOI: doi:10.48550/arXiv.2107.08808
   Type: Article
   Published by: arXiv

10. doi:10.2139/ssrn.3911490
    Title: Bankruptcy Prediction of Privately Held SMEs Using Feature Selection Methods
    Authors: Florentina Paraschiv; Markus Schmid; Ranik Raaen Wahlstrøm
    DOI: doi:10.2139/ssrn.3911490
    Type: Journal article
    Published in: SSRN Electronic Journal
    Published by: Elsevier BV
    ISSN: 1556-5068

11. doi:10.1007/s42521-022-00048-8
    Title: Indices on cryptocurrencies: an evaluation
    Authors: Konstantin Häusler; Hongyu Xia
    DOI: doi:10.1007/s42521-022-00048-8
    Type: Journal article
    Published in: Digital Finance
    Published by: Springer Science and Business Media LLC
    ISSNs: 2524-6984; 2524-6186
    Subject: General Engineering
    Links: https://link.springer.com/content/pdf/10.1007/s42521-022-00048-8.pdf; https://link.springer.com/article/10.1007/s42521-022-00048-8/fulltext.html

12. doi:10.1007/s10614-021-10113-w
    Title: A Comparative Analysis of Parsimonious Yield Curve Models with Focus on the Nelson-Siegel, Svensson and Bliss Versions
    Authors: Ranik Raaen Wahlstrøm; Florentina Paraschiv; Michael Schürle
    DOI: doi:10.1007/s10614-021-10113-w
    Type: Journal article
    Published in: Computational Economics
    Published by: Springer Science and Business Media LLC
    ISSNs: 0927-7099; 1572-9974
    Subjects: Computer Science Applications; Economics, Econometrics and Finance (miscellaneous)
    Links: https://link.springer.com/content/pdf/10.1007/s10614-021-10113-w.pdf; https://link.springer.com/article/10.1007/s10614-021-10113-w/fulltext.html

13. doi:10.2139/ssrn.3987941
    Title: Robustifying Markowitz
    Authors: Yegor Klochkov; Alla Petukhina; Wolfgang K. Härdle; Nikita Zhivotovskiy
    DOI: doi:10.2139/ssrn.3987941

Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

14. doi:10.1142/S0217590822480010

Title	FINANCIAL RISK METER FOR CRYPTOCURRENCIES AND TAIL RISK NETWORK-BASED PORTFOLIO CONSTRUCTION
Authors	RUI REN; MICHAEL ALTHOF; WOLFGANG KARL HÄRDLE
DOI	doi:10.1142/S0217590822480010
Type	Journal article
Published in	The Singapore Economic Review
Published by	World Scientific Pub Co Pte Ltd
ISSNs	0217-5908; 1793-6837
Subject	Economics and Econometrics
Link	https://www.worldscientific.com/doi/pdf/10.1142/S0217590822480010

15. doi:10.48550/arXiv.2108.05721

Title	Networks of News and Cross-Sectional Returns
Authors	Junjie Hu; Wolfgang Karl Härdle
DOI	doi:10.48550/arXiv.2108.05721
Type	Article
Published by	arXiv

16. doi:10.1016/j.jmva.2021.104869

Title	K-expectiles clustering
Authors	Bingling Wang; Yingxing Li; Wolfgang Karl Härdle
DOI	doi:10.1016/j.jmva.2021.104869
Type	Journal article
Published in	Journal of Multivariate Analysis
Published by	Elsevier BV
ISSN	0047-259X
Subjects	Statistics, Probability and Uncertainty; Numerical Analysis; Statistics and Probability
Links	https://api.elsevier.com/content/article/PII:S0047259X21001470?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0047259X21001470?httpAccept=text/plain

17. doi:10.2139/ssrn.4079006

Title	Uniform Confidence Bands for Generalized Random Forests
Authors	Kainat Khowaja; Chen Huang; Wolfgang K. Härdle
DOI	doi:10.2139/ssrn.4079006
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

18. doi:10.48550/arXiv.2204.02757

Title	Does non-linear factorization of financial returns help build better and stabler portfolios?
Authors	Bruno Spilak; Wolfgang Karl Härdle

DOI	doi:10.48550/arXiv.2204.02757
Type	Article
Published by	arXiv

19. doi:10.1007/s00181-021-02027-1

Title	The common and specific components of inflation expectations across European countries
Authors	Shi Chen; Wolfgang Karl Härdle; Weining Wang
DOI	doi:10.1007/s00181-021-02027-1
Type	Journal article
Published in	Empirical Economics
Published by	Springer Science and Business Media LLC
ISSNs	0377-7332; 1435-8921
Subjects	Economics and Econometrics; Social Sciences (miscellaneous); Mathematics (miscellaneous); Statistics and Probability
Links	https://link.springer.com/content/pdf/10.1007/s00181-021-02027-1.pdf; https://link.springer.com/article/10.1007/s00181-021-02027-1/fulltext.html

20. doi:10.2139/ssrn.4150849

Title	Hedging Cryptos with Bitcoin Futures
Authors	Francis Liu; Natalie Packham; Meng-Jou Lu; Wolfgang K. Härdle
DOI	doi:10.2139/ssrn.4150849
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

21. doi:10.48550/arXiv.2110.09429

Title	Understanding jumps in high frequency digital asset markets
Authors	Danial Saef; Odett Nagy; Sergej Sizov; Wolfgang Karl Härdle
DOI	doi:10.48550/arXiv.2110.09429
Type	Article
Published by	arXiv

22. doi:10.48550/arXiv.2108.11921

Title	A Time-Varying Network for Cryptocurrencies
Authors	Li Guo; Wolfgang Karl Härdle; Yubo Tao
DOI	doi:10.48550/arXiv.2108.11921
Type	Article
Published by	arXiv

23. doi:10.6293/AQAFA.202112_(18).0006

Title	BLOCKCHAIN MECHANISM AND DISTRIBUTIONAL CHARACTERISTICS OF CRYPTOS
Authors	Min-Bin Lin; Kainat Khowaja; Cathy Yi-Hsuan Chen; Wolfgang Karl Härdle
DOI	doi:10.6293/AQAFA.202112_(18).0006
Type	Journal article
Published in	Advances in Quantitative Analysis of Finance and Accounting

24. doi:10.2139/ssrn.3912753

Title	A Data-driven Explainable Case-based Reasoning Approach for Financial Risk Detection
Authors	Wei Li; Florentina Paraschiv; Georgios Sermpinis
DOI	doi:10.2139/ssrn.3912753
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

25. doi:10.48550/arXiv.2103.08447

Title	Understanding Smart Contracts: Hype or Hope?
Authors	Elizaveta Zinovyeva; Raphael C. G. Reule; Wolfgang Karl Härdle
DOI	doi:10.48550/arXiv.2103.08447
Type	Article
Published by	arXiv

26. doi:10.1007/s42521-022-00064-8

Title	Discussion on: “Programmable money: next generation blockchain-based conditional payments” by Ingo Weber and Mark Staples
Author	Michael C. Burda
DOI	doi:10.1007/s42521-022-00064-8
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
Links	https://link.springer.com/content/pdf/10.1007/s42521-022-00064-8.pdf; https://link.springer.com/article/10.1007/s42521-022-00064-8/fulltext.html

27. doi:10.1016/j.jcomm.2021.100189

Title	Modelling the evolution of wind and solar power infeed forecasts
Authors	Wei Li; Florentina Paraschiv
DOI	doi:10.1016/j.jcomm.2021.100189
Type	Journal article
Published in	Journal of Commodity Markets
Published by	Elsevier BV
ISSN	2405-8513
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S2405851321000234?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S2405851321000234?httpAccept=text/plain

28. doi:10.48550/arXiv.2101.10189

Title	Surrogate Models for Optimization of Dynamical Systems
Authors	Kainat Khowaja; Mykhaylo Shcherbatyy; Wolfgang Karl Härdle
DOI	doi:10.48550/arXiv.2101.10189
Type	Article
Published by	arXiv

29. doi:10.48550/arXiv.2108.11915

Title	Cooling Measures and Housing Wealth: Evidence from Singapore
Authors	Wolfgang Karl Härdle; Rainer Schulz; Taojun Sie
DOI	doi:10.48550/arXiv.2108.11915
Type	Article
Published by	arXiv

30. doi:10.1016/j.jmva.2021.104881

Title	Financial Risk Meter FRM based on Expectiles
Authors	Rui Ren; Meng-Jou Lu; Yingxing Li; Wolfgang Karl Härdle
DOI	doi:10.1016/j.jmva.2021.104881
Type	Journal article
Published in	Journal of Multivariate Analysis
Published by	Elsevier BV
ISSN	0047-259X
Subjects	Statistics, Probability and Uncertainty; Numerical Analysis; Statistics and Probability
Links	https://api.elsevier.com/content/article/PII:S0047259X21001597?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0047259X21001597?httpAccept=text/plain

31. doi:10.2139/ssrn.3699345

Title	A Machine Learning Based Regulatory Risk Index for Cryptocurrencies
Author	Xinwen Ni
DOI	doi:10.2139/ssrn.3699345
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

32. doi:10.1080/1351847X.2021.1960403

Title	Are cryptos becoming alternative assets?
Authors	Daniel Traian Pele; Niels Wesselhöfft; Wolfgang Karl Härdle; Michalis Kolossiatis; Yannis G. Yatracos
DOI	doi:10.1080/1351847X.2021.1960403
Type	Journal article
Published in	The European Journal of Finance
Published by	Informa UK Limited
ISSNs	1351-847X; 1466-4364
Subject	Economics, Econometrics and Finance (miscellaneous)
Link	https://www.tandfonline.com/doi/pdf/10.1080/1351847X.2021.1960403

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Title	The Use of M2P in Business Process Improvement and Optimization
Authors	Meriem Kherbouche; Yossra Zghal; Bálint Molnár; András Benczúr
DOI	doi:10.1007/978-3-031-15743-1_11
Type	Book chapter
Published in	New Trends in Database and Information Systems

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Link https://link.springer.com/content/pdf/10.1007/978-3-031-15743-1_11

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Title Forecasting: theory and practice
Authors Fotios Petropoulos; Daniele Apiletti; Vassilios Assimakopoulos; Mohamed Zied Babai; Devon K. Barrow; Souhaib Ben Taieb; Christoph Bergmeir; Ricardo J. Bessa; Jakub Bijak; John E. Boylan; Jethro Browell; Claudio Carnevale; Jennifer L. Castle; Pasquale Cirillo; Michael P. Clements; Clara Cordeiro; Fernando Luiz Cyrino Oliveira; Shari De Baets; Alexander Dokumentov; Joanne Ellison; Piotr Fiszeder; Philip Hans Franses; David T. Frazier; Michael Gilliland; M. Sinan Gönül; Paul Goodwin; Luigi Grossi; Yael Grushka-Cockayne; Mariangela Guidolin; Massimo Guidolin; Ulrich Gunter; Xiaojia Guo; Renato Guseo; Nigel Harvey; David F. Hendry; Ross Hollyman; Tim Januschowski; Jooyoung Jeon; Victor Richmond R. Jose; Yanfei Kang; Anne B. Koehler; Stephan Kolassa; Nikolaos Kourentzes; Sonia Leva; Feng Li; Konstantia Litsiou; Spyros Makridakis; Gael M. Martin; Andrew B. Martinez; Sheik Meeran; Theodore Modis; Konstantinos Nikolopoulos; Dilek Önkal; Alessia Paccagnini; Anastasios Panagiotelis; Ioannis Panapakidis; Jose M. Pavía; Manuela Pedio; Diego J. Pedregal ; Pierre Pinson; Patrícia Ramos; David E. Rapach; J. James Reade; Bahman Rostami-Tabar; Michał Rubaszek; Georgios Sermpinis; Han Lin Shang; Evangelos Spiliotis; Aris A. Syntetos; Priyanga Dilini Talagala; Thiyanga S. Talagala; Len Tashman; Dimitrios Thomakos; Thordis Thorarinsdottir; Ezio Todini; Juan Ramón Trapero Arenas; Xiaoqian Wang; Robert L. Winkler; Alisa Yusupova; Florian Ziel
DOI doi:10.1016/j.ijforecast.2021.11.001
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Subject Business and International Management
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Title Editorial for Special Issue “New Frontiers in Forecasting the Business Cycle and Financial Markets”
Author Alessia Paccagnini
DOI doi:10.3390/forecast3030030
Type Journal article
Published in Forecasting

Published by	MDPI AG
ISSN	2571-9394
Subject	General Medicine
Link	https://www.mdpi.com/2571-9394/3/3/30/pdf

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Title	Food Prices, Ethics and Forms of Speculation
Authors	Don Bredin; Valerio Potì; Enrique Salvador
DOI	doi:10.1007/s10551-021-04842-z
Type	Journal article
Published in	Journal of Business Ethics
Published by	Springer Science and Business Media LLC
ISSNs	0167-4544; 1573-0697
Subjects	Law; Economics and Econometrics; Arts and Humanities (miscellaneous); General Business, Management and Accounting; Business and International Management
Links	https://link.springer.com/content/pdf/10.1007/s10551-021-04842-z.pdf; https://link.springer.com/article/10.1007/s10551-021-04842-z/fulltext.html

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Title	Crypto-environment network connectivity and Bitcoin returns distribution tail behaviour
Authors	Rocco Caferra; Andrea Morone; Valerio Potì
DOI	doi:10.1016/j.econlet.2022.110734
Type	Journal article
Published in	Economics Letters
Published by	Elsevier BV
ISSN	0165-1765
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S0165176522002555?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0165176522002555?httpAccept=text/plain

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Title	Discussion on: “Programmable money: next generation blockchain based conditional payments” by Ingo Weber and Mark Staples
Author	Valerio Poti
DOI	doi:10.1007/s42521-022-00060-y
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
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Title	Can ESG Shape Cost of Capital? A Bibliometric Review and Empirical Analysis Through ML
Authors	Niklas Bussmann; Alessandra Tanda; Ellen Pei-yi Yu

DOI	doi:10.2139/ssrn.4173890
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

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Title	The role of Environmental, Social, and Governance (ESG) in predicting bank financial distress
Authors	Alberto Citterio; Timothy King
DOI	doi:10.1016/j.frl.2022.103411
Type	Journal article
Published in	Finance Research Letters
Published by	Elsevier BV
ISSN	1544-6123
Subject	Finance
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Title	Cryptocurrencies and stablecoins: a high-frequency analysis
Authors	Emilio Barucci; Giancarlo Giuffra Moncayo; Daniele Marazzina
DOI	doi:10.1007/s42521-022-00055-9
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Published by	Springer Science and Business Media LLC
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42. doi:10.1016/j.eswa.2021.116261

Title	A machine learning model for lapse prediction in life insurance contracts
Authors	Michele Azzone; Emilio Barucci; Giancarlo Giuffra Moncayo; Daniele Marazzina
DOI	doi:10.1016/j.eswa.2021.116261
Type	Journal article
Published in	Expert Systems with Applications
Published by	Elsevier BV
ISSN	0957-4174
Subjects	Artificial Intelligence; Computer Science Applications; General Engineering
Links	https://api.elsevier.com/content/article/PII:S0957417421015700?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0957417421015700?httpAccept=text/plain

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Title	Explainable artificial intelligence for crypto asset allocation

Authors	Golnoosh Babaei; Paolo Giudici; Emanuela Raffinetti
DOI	doi:10.1016/j.frl.2022.102941
Type	Journal article
Published in	Finance Research Letters
Published by	Elsevier BV
ISSN	1544-6123
Subject	Finance
Links	https://api.elsevier.com/content/article/PII:S1544612322002021?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S1544612322002021?httpAccept=text/plain

44. doi:10.1016/j.eswa.2020.114104

Title	Shapley-Lorenz eXplainable Artificial Intelligence
Authors	Paolo Giudici; Emanuela Raffinetti
DOI	doi:10.1016/j.eswa.2020.114104
Type	Journal article
Published in	Expert Systems with Applications
Published by	Elsevier BV
ISSN	0957-4174
Subjects	Artificial Intelligence; Computer Science Applications; General Engineering
Links	https://api.elsevier.com/content/article/PII:S0957417420308575?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0957417420308575?httpAccept=text/plain

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Title	Discussion on: “Programmable money: next generation blockchain based conditional payments” by Ingo Weber and Mark Staples
Author	Audrius Kabasinskas
DOI	doi:10.1007/s42521-022-00062-w
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
Links	https://link.springer.com/content/pdf/10.1007/s42521-022-00062-w.pdf; https://link.springer.com/article/10.1007/s42521-022-00062-w/fulltext.html

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Title	Clustering of Latvian Pension Funds Using Convolutional Neural Network Extracted Features
Authors	Vitalija Serapinaitė; Audrius Kabašinskas
DOI	doi:10.3390/math9172086
Type	Journal article
Published in	Mathematics
Published by	MDPI AG
ISSN	2227-7390
Subjects	General Mathematics; Engineering (miscellaneous); Computer Science (miscellaneous)
Link	https://www.mdpi.com/2227-7390/9/17/2086/pdf

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Title	Review of Multi-Criteria Decision-Making Methods in Finance Using Explainable Artificial Intelligence
Authors	Jurgita Černevičienė; Audrius Kabašinskas
DOI	doi:10.3389/frai.2022.827584
Type	Journal article
Published in	Frontiers in Artificial Intelligence
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ISSN	2624-8212
Link	https://www.frontiersin.org/articles/10.3389/frai.2022.827584/full

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Title	Discussion on: “Programmable money: next generation blockchain based conditional payments” by Ingo Weber and Mark Staples
Author	Olivija Filipovska
DOI	doi:10.1007/s42521-022-00065-7
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
Links	https://link.springer.com/content/pdf/10.1007/s42521-022-00065-7.pdf; https://link.springer.com/article/10.1007/s42521-022-00065-7/fulltext.html

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Title	Empirical study of day-ahead electricity spot-price forecasting: Insights into a novel loss function for training neural networks
Authors	Ahmad Amine Loutfi; Mengtao Sun; Ijlal Loutfi; Per Bjarte Solibakke
DOI	doi:10.1016/j.apenergy.2022.119182
Type	Journal article
Published in	Applied Energy
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Title	Projecting and Forecasting the Latent Volatility for the Nasdaq OMX Nordic/Baltic Financial Electricity Market Applying Stochastic Volatility Market Characteristics
Author	Per Bjarte Solibakke
DOI	doi:10.3390/en15103839
Type	Journal article
Published in	Energies
Published by	MDPI AG
ISSN	1996-1073

Subjects	Energy (miscellaneous); Energy Engineering and Power Technology; Renewable Energy, Sustainability and the Environment; Electrical and Electronic Engineering; Control and Optimization; Engineering (miscellaneous)
Link	https://www.mdpi.com/1996-1073/15/10/3839/pdf

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Title	Bootstrapped nonlinear impulse-response analysis: the FTSE100 (UK) and the NDX100 (US) indices 2012-2021
Author	Per Bjarte Solibakke
DOI	doi:10.1504/IJCEE.2021.10043332
Type	Journal article
Published in	International Journal of Computational Economics and Econometrics
Published by	Inderscience Publishers
ISSNs	1757-1170; 1757-1189
Subjects	Computer Science Applications; Economics and Econometrics
Link	http://www.inderscienceonline.com/doi/full/10.1504/IJCEE.2022.120531

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Title	Stochastic Volatility Models Predictive Relevance for Equity Markets
Author	Per Bjarte Solibakke
DOI	doi:10.1007/978-3-030-56219-9_9
Type	Book chapter
Published in	Contributions to Statistics
Published by	Springer International Publishing
ISSN	1431-1968
Link	http://link.springer.com/content/pdf/10.1007/978-3-030-56219-9_9

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Title	Identification of Scams in Initial Coin Offerings With Machine Learning
Authors	Bedil Karimov; Piotr Wójcik
DOI	doi:10.3389/frai.2021.718450
Type	Journal article
Published in	Frontiers in Artificial Intelligence
Published by	Frontiers Media SA
ISSN	2624-8212
Subject	General Medicine
Link	https://www.frontiersin.org/articles/10.3389/frai.2021.718450/full

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Title	A Generic Approach to Extend Interpretability of Deep Networks
Authors	Catarina Silva; António Morais; Bernardete Ribeiro
DOI	doi:10.1007/978-3-031-16474-3_40
Type	Book chapter
Published in	Progress in Artificial Intelligence
Published by	Springer International Publishing
ISSNs	0302-9743; 1611-3349

Link	https://link.springer.com/content/pdf/10.1007/978-3-031-16474-3_40

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Title	Is Trust a Valid Indicator of Tax Compliance Behaviour? A Study on Taxpayers' Public Perception Using Sentiment Analysis Tools
Authors	Coita Ioana-Florina; Cioban Ștefana; Mare Codruța
DOI	doi:10.1007/978-3-030-93286-2_7
Type	Book chapter
Published in	Digitalization and Big Data for Resilience and Economic Intelligence
Published by	Springer International Publishing
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Link	https://link.springer.com/content/pdf/10.1007/978-3-030-93286-2_7

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Title	The Utility of Neural Model in Predicting Tax Avoidance Behavior
Authors	Coita Ioana-Florina; Codruţa Mare
DOI	doi:10.1007/978-981-16-2765-1_6
Type	Book chapter
Published in	Intelligent Decision Technologies
Published by	Springer Singapore
ISSNs	2190-3018; 2190-3026
Link	https://link.springer.com/content/pdf/10.1007/978-981-16-2765-1_6

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Title	A Statistical Model of Fraud Risk in Financial Statements. Case for Romania Companies
Authors	Andrada-Ioana Sabău (Popa); Codruța Mare; Ioana Lavinia Safta
DOI	doi:10.3390/risks9060116
Type	Journal article
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ISSN	2227-9091
Subjects	Strategy and Management; Economics, Econometrics and Finance (miscellaneous); Accounting
Link	https://www.mdpi.com/2227-9091/9/6/116/pdf

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Title	Privacy Intrusiveness in Financial-Banking Fraud Detection
Authors	Larisa Găbudeanu; Iulia Brici; Codruța Mare; Ioan Cosmin Mihai; Mircea Constantin Șcheau
DOI	doi:10.3390/risks9060104
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Title	Machine Learning Models for Predicting Romanian Farmers' Purchase of Crop Insurance
Authors	Codruţa Mare; Daniela Manaţe; Gabriela-Mihaela Mureşan; Simona Laura Dragoş; Cristian Mihai Dragoş; Alexandra-Anca Purcel
DOI	doi:10.3390/math10193625
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Published in	Mathematics
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Subjects	General Mathematics; Engineering (miscellaneous); Computer Science (miscellaneous)
Link	https://www.mdpi.com/2227-7390/10/19/3625/pdf

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Title	Echo State Networks Usage for Stock Price Predictions
Authors	Lidija Barjaktarović; Marko Barjaktarović; Snežana Konjikušić
DOI	doi:10.15308/finiz-2020-97-102
Type	Proceedings article
Published in	Proceedings of the 7th International Scientific Conference - FINIZ 2020
Published by	Singidunum University
Link	http://portal.finiz.singidunum.ac.rs/Media/files/2020/97-102.pdf

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Title	Financial literacy and psychological disaster preparedness: applicability of approach based on fuzzy functional dependencies
Authors	Miljan Vučetić; Zuzana Brokešová; Miroslav Hudec; Erika Pastoráková
DOI	doi:10.1016/j.ipm.2021.102848
Type	Journal article
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Title	Risk-return modelling in the p2p lending market: Trends, gaps, recommendations and future directions
Authors	Miller-Janny Ariza-Garzón; María-Del-Mar Camacho-Miñano; María-Jesús Segovia-Vargas; Javier Arroyo

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Title	Analysis of the cryptocurrency market using different prototype-based clustering techniques
Authors	Luis Lorenzo; Javier Arroyo
DOI	doi:10.1186/s40854-021-00310-9
Type	Journal article
Published in	Financial Innovation
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ISSN	2199-4730
Subjects	Management of Technology and Innovation; Finance
Links	https://link.springer.com/content/pdf/10.1186/s40854-021-00310-9.pdf; https://link.springer.com/article/10.1186/s40854-021-00310-9/fulltext.html

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Title	Discussion on: “Programmable money: next generation blockchain based conditional payments” by Ingo Weber and Mark Staples
Author	Joerg Osterrieder
DOI	doi:10.1007/s42521-022-00063-9
Type	Journal article
Published in	Digital Finance
Published by	Springer Science and Business Media LLC
ISSNs	2524-6984; 2524-6186
Subject	General Engineering
Links	https://link.springer.com/content/pdf/10.1007/s42521-022-00063-9.pdf; https://link.springer.com/article/10.1007/s42521-022-00063-9/fulltext.html

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Title	THE VIX INDEX UNDER SCRUTINY OF MACHINE LEARNING TECHNIQUES AND NEURAL NETWORKS
Authors	Ali Hirsa; Branka Hadji Misheva; Joerg Osterrieder; Wenxin Cao; Yiwen Fu; Hanze Sun; Kin Wai Wong
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Type	Journal article
Published in	SSRN Electronic Journal
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66. doi:10.3389/frai.2021.668465

Title	The Applicability of Self-Play Algorithms to Trading and Forecasting Financial Markets
Authors	Jan-Alexander Posth; Piotr Kotlarz; Branka Hadji Misheva; Joerg Osterrieder; Peter Schwendner
DOI	doi:10.3389/frai.2021.668465
Type	Journal article
Published in	Frontiers in Artificial Intelligence
Published by	Frontiers Media SA
ISSN	2624-8212
Subject	General Medicine
Link	https://www.frontiersin.org/articles/10.3389/frai.2021.668465/full

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Title	Deep Reinforcement Learning for Finance and the Efficient Market Hypothesis
Authors	Leander Odermatt; Jetmir Beqiraj; Joerg Osterrieder
DOI	doi:10.2139/ssrn.3865019
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
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Title	Deep Reinforcement Learning on a Multi-Asset Environment for Trading
Authors	Ali Hirsa; Branka Hadji Misheva; Joerg Osterrieder; Jan-Alexander Posth
DOI	doi:10.2139/ssrn.3867800
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69. doi:10.2139/ssrn.3864965

Title	Generative Adversarial Networks in finance: an overview
Author	Florian Eckerli
DOI	doi:10.2139/ssrn.3864965
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Published in	SSRN Electronic Journal
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70. doi:10.2139/ssrn.3864867

Title	Generative Adversarial Network For synthetic data on Bitcoin returns
Author	Moritz Pfenninger
DOI	doi:10.2139/ssrn.3864867
Type	Journal article
Published in	SSRN Electronic Journal
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71. doi:10.2139/ssrn.3898792

Title	Analyzing Deep Generated Financial Time Series

	for Various Asset Classes
Authors	Antonio Rosolia; Joerg Osterrieder
DOI	doi:10.2139/ssrn.3898792
Type	Journal article
Published in	SSRN Electronic Journal
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Title	Audience-Dependent Explanations for AI-Based Risk Management Tools: A Survey
Authors	Branka Hadji Misheva; David Jaggi; Jan-Alexander Posth; Thomas Gramespacher; Joerg Osterrieder
DOI	doi:10.3389/frai.2021.794996
Type	Journal article
Published in	Frontiers in Artificial Intelligence
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Subject	General Medicine
Link	https://www.frontiersin.org/articles/10.3389/frai.2021.794996/full

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Title	Risk Parity for Multi-Asset Futures Allocation – A Practical Analysis of the Equal Risk Contribution Portfolio
Authors	Chris Bucher; Joerg Osterrieder
DOI	doi:10.2139/ssrn.3858730
Type	Journal article
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Title	High-Frequency Causality between Stochastic Volatility Time Series: Empirical Evidence
Authors	Kia Farokhnia; Joerg Osterrieder
DOI	doi:10.2139/ssrn.4087569
Type	Journal article
Published in	SSRN Electronic Journal
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ISSN	1556-5068

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Title	Tackling the Exponential Scaling of Signature-Based Generative Adversarial Networks for High-Dimensional Financial Time-Series Generation
Authors	Fernando de Meer Pardo; Peter Schwendner; Marcus Wunsch
DOI	doi:10.3905/jfds.2022.1.109
Type	Journal article
Published in	The Journal of Financial Data Science
Published by	Pageant Media US
ISSN	2640-3943
Subject	General Medicine
Link	https://syndication.highwire.org/content/doi/10.3905/jfds.2022.1.109

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Title	Adaptive Seriational Risk Parity and Other Extensions for Heuristic Portfolio Construction Using Machine Learning and Graph Theory
Authors	Peter Schwendner; Jochen Papenbrock; Markus Jaeger; Stephan Krügel
DOI	doi:10.3905/jfds.2021.1.078
Type	Journal article
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Published by	Pageant Media US
ISSN	2640-3943
Link	https://syndication.highwire.org/content/doi/10.3905/jfds.2021.1.078

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Title	Bankers' remuneration reforms and new challenges
Author	Anna (Ania) Zalewska
DOI	doi:10.1111/corg.12454
Type	Journal article
Published in	Corporate Governance: An International Review
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Subjects	Management of Technology and Innovation; Strategy and Management; General Business, Management and Accounting
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Title	The impact of machine learning and big data on credit markets
Authors	Peter Eccles; Paul Grout; Paolo Siciliani; Anna Zalewska
DOI	doi:10.2139/ssrn.3890364
Type	Journal article
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79. doi:10.2139/ssrn.4227111

Title	To Bao or Not to Bao? Payment Innovation and Money Market Mutual Funds
Authors	Anna Zalewska; Yue Zhang; Zhe Zong
DOI	doi:10.2139/ssrn.4227111
Type	Journal article
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ISSN	1556-5068
Subjects	General Earth and Planetary Sciences; General Environmental Science

80. doi:10.2139/ssrn.4002279

Title	Investor Demand in Syndicated Bond Issuances: Stylised Facts
Authors	Martin Hillebrand; Marko Mravlak; Peter

	Schwendner
DOI	doi:10.2139/ssrn.4002279
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068

81. doi:10.1007/978-3-030-51093-0

Title	Financial Risk Management for Cryptocurrencies
Authors	Eline Van der Auwera; Wim Schoutens; Marco Petracco Giudici; Lucia Alessi
DOI	doi:10.1007/978-3-030-51093-0
Type	Book
Published in	SpringerBriefs in Finance
Published by	Springer International Publishing
ISSNs	2193-1720; 2193-1739
Links	http://link.springer.com/content/pdf/10.1007/978-3-030-51093-0.pdf; http://link.springer.com/content/pdf/10.1007/978-3-030-51093-0

82. doi:10.1007/s11634-022-00508-4

Title	On mathematical optimization for clustering categories in contingency tables
Authors	Emilio Carrizosa; Vanesa Guerrero; Dolores Romero Morales
DOI	doi:10.1007/s11634-022-00508-4
Type	Journal article
Published in	Advances in Data Analysis and Classification
Published by	Springer Science and Business Media LLC
ISSNs	1862-5347; 1862-5355
Subjects	Applied Mathematics; Computer Science Applications; Statistics and Probability
Links	https://link.springer.com/content/pdf/10.1007/s11634-022-00508-4.pdf; https://link.springer.com/article/10.1007/s11634-022-00508-4/fulltext.html

83. doi:10.1016/j.eswa.2022.117423

Title	The tree based linear regression model for hierarchical categorical variables
Authors	Emilio Carrizosa; Laust Hvas Mortensen; Dolores Romero Morales; M. Remedios Sillero-Denamiel
DOI	doi:10.1016/j.eswa.2022.117423
Type	Journal article
Published in	Expert Systems with Applications
Published by	Elsevier BV
ISSN	0957-4174
Subjects	Artificial Intelligence; Computer Science Applications; General Engineering
Links	https://api.elsevier.com/content/article/PII:S0957417422007620X?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0957417422007620X?httpAccept=text/plain

84. doi:10.1016/j.ejor.2021.12.022

Title	On sparse optimal regression trees
Authors	Rafael Blanquero; Emilio Carrizosa; Cristina

Molero-Río; Dolores Romero Morales
DOI doi:10.1016/j.ejor.2021.12.022
Type Journal article
Published in European Journal of Operational Research
Published by Elsevier BV
ISSN 0377-2217
Subjects Information Systems and Management; Management Science and Operations Research; Modeling and Simulation; General Computer Science; Industrial and Manufacturing Engineering
Links https://api.elsevier.com/content/article/PII:S0377221721010626?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0377221721010626?httpAccept=text/plain

85. doi:10.1016/j.omega.2021.102543
Title Interpreting clusters via prototype optimization
Authors Emilio Carrizosa; Kseniia Kurishchenko; Alfredo Marín; Dolores Romero Morales
DOI doi:10.1016/j.omega.2021.102543
Type Journal article
Published in Omega
Published by Elsevier BV
ISSN 0305-0483
Subjects Information Systems and Management; Management Science and Operations Research; Strategy and Management
Links https://api.elsevier.com/content/article/PII:S0305048321001523?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0305048321001523?httpAccept=text/plain

86. doi:10.1016/j.eswa.2021.115245
Title On clustering categories of categorical predictors in generalized linear models
Authors Emilio Carrizosa; Marcela Galvis Restrepo; Dolores Romero Morales
DOI doi:10.1016/j.eswa.2021.115245
Type Journal article
Published in Expert Systems with Applications
Published by Elsevier BV
ISSN 0957-4174
Subjects Artificial Intelligence; Computer Science Applications; General Engineering
Links https://api.elsevier.com/content/article/PII:S0957417421006771?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0957417421006771?httpAccept=text/plain

87. doi:10.1016/j.ejor.2021.04.016
Title On sparse ensemble methods: An application to short-term predictions of the evolution of COVID-19
Authors Sandra Benítez-Peña; Emilio Carrizosa; Vanesa Guerrero; M. Dolores Jiménez-Gamero; Belén Martín-Barragán; Cristina Molero-Río; Pepa Ramírez-Cobo; Dolores Romero Morales; M.

	Remedios Sillero-Denamiel
DOI	doi:10.1016/j.ejor.2021.04.016
Type	Journal article
Published in	European Journal of Operational Research
Published by	Elsevier BV
ISSN	0377-2217
Subjects	Information Systems and Management; Management Science and Operations Research; Modeling and Simulation; General Computer Science; Industrial and Manufacturing Engineering
Links	https://api.elsevier.com/content/article/PII:S0377221721003283?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0377221721003283?httpAccept=text/plain

88. doi:10.1016/j.cor.2021.105281

Title	Optimal randomized classification trees
Authors	Rafael Blanquero; Emilio Carrizosa; Cristina Molero-Río; Dolores Romero Morales
DOI	doi:10.1016/j.cor.2021.105281
Type	Journal article
Published in	Computers & Operations Research
Published by	Elsevier BV
ISSN	0305-0548
Subjects	Management Science and Operations Research; Modeling and Simulation; General Computer Science
Links	https://api.elsevier.com/content/article/PII:S0305054821000733?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0305054821000733?httpAccept=text/plain

89. doi:10.1007/s11750-021-00594-1

Title	Mathematical optimization in classification and regression trees
Authors	Emilio Carrizosa; Cristina Molero-Río; Dolores Romero Morales
DOI	doi:10.1007/s11750-021-00594-1
Type	Journal article
Published in	TOP
Published by	Springer Science and Business Media LLC
ISSNs	1134-5764; 1863-8279
Subjects	Discrete Mathematics and Combinatorics; Statistics and Probability; Management Science and Operations Research; Information Systems and Management; Modeling and Simulation
Links	http://link.springer.com/content/pdf/10.1007/s11750-021-00594-1.pdf; http://link.springer.com/article/10.1007/s11750-021-00594-1/fulltext.html

90. doi:10.1016/j.omega.2019.05.004

Title	Feature Selection in Data Envelopment Analysis: A Mathematical Optimization approach
Authors	Sandra Benítez-Peña; Peter Bogetoft; Dolores Romero Morales
DOI	doi:10.1016/j.omega.2019.05.004

Type	Journal article
Published in	Omega
Published by	Elsevier BV
ISSN	0305-0483
Subjects	Information Systems and Management; Management Science and Operations Research; Strategy and Management
Links	https://api.elsevier.com/content/article/PII:S0305048318312131?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S0305048318312131?httpAccept=text/plain

91. doi:10.1016/j.ejor.2019.12.002

Title	Sparsity in optimal randomized classification trees
Authors	Rafael Blanquero; Emilio Carrizosa; Cristina Molero-Río; Dolores Romero Morales
DOI	doi:10.1016/j.ejor.2019.12.002
Type	Journal article
Published in	European Journal of Operational Research
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ISSN	0377-2217
Subjects	Information Systems and Management; Management Science and Operations Research; Modeling and Simulation; General Computer Science; Industrial and Manufacturing Engineering
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92. doi:10.1016/j.intfin.2021.101321

Title	The effects of a “black swan” event (COVID-19) on herding behavior in cryptocurrency markets
Authors	Larisa Yarovaya; Roman Matkovskyy; Akanksha Jalan
DOI	doi:10.1016/j.intfin.2021.101321
Type	Journal article
Published in	Journal of International Financial Markets, Institutions and Money
Published by	Elsevier BV
ISSN	1042-4431
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S1042443121000408?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S1042443121000408?httpAccept=text/plain

93. doi:10.1016/j.irfa.2021.101958

Title	“Shiny” crypto assets: A systemic look at gold-backed cryptocurrencies during the COVID-19 pandemic
Authors	Akanksha Jalan; Roman Matkovskyy; Larisa Yarovaya
DOI	doi:10.1016/j.irfa.2021.101958
Type	Journal article
Published in	International Review of Financial Analysis
Published by	Elsevier BV

ISSN	1057-5219
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S1057521921002787?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S1057521921002787?httpAccept=text/plain

94. doi:10.1080/1351847X.2020.1869992

Title	What effect did the introduction of Bitcoin futures have on the Bitcoin spot market?
Authors	Akanksha Jalan; Roman Matkovskyy; Andrew Urquhart
DOI	doi:10.1080/1351847X.2020.1869992
Type	Journal article
Published in	The European Journal of Finance
Published by	Informa UK Limited
ISSNs	1351-847X; 1466-4364
Subject	Economics, Econometrics and Finance (miscellaneous)
Link	https://www.tandfonline.com/doi/pdf/10.1080/1351847X.2020.1869992

95. doi:10.1214/20-AOS2019

Title	LASSO-driven inference in time and space
Authors	Victor Chernozhukov; Wolfgang Karl Härdle; Chen Huang; Weining Wang
DOI	doi:10.1214/20-AOS2019
Type	Journal article
Published in	The Annals of Statistics
Published by	Institute of Mathematical Statistics
ISSN	0090-5364
Subjects	Statistics, Probability and Uncertainty; Statistics and Probability

96. doi:10.1080/14697688.2021.1880023

Title	Investing with cryptocurrencies – evaluating their potential for portfolio allocation strategies
Authors	Alla Petukhina; Simon Trimborn; Wolfgang Karl Härdle; Hermann Elendner
DOI	doi:10.1080/14697688.2021.1880023
Type	Journal article
Published in	Quantitative Finance
Published by	Informa UK Limited
ISSNs	1469-7688; 1469-7696
Subjects	General Economics, Econometrics and Finance; Finance
Link	https://www.tandfonline.com/doi/pdf/10.1080/14697688.2021.1880023

97. doi:10.1016/j.jedc.2021.104290

Title	Media-expressed tone, option characteristics, and stock return predictability
Authors	Cathy Yi-Hsuan Chen; Matthias R. Fengler; Wolfgang Karl Härdle; Yanchu Liu
DOI	doi:10.1016/j.jedc.2021.104290
Type	Journal article
Published in	Journal of Economic Dynamics and Control
Published by	Elsevier BV

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98. doi:10.1016/j.irfa.2021.101915

Title	VCRIX — A volatility index for crypto-currencies
Authors	Alisa Kim; Simon Trimborn; Wolfgang Karl Härdle
DOI	doi:10.1016/j.irfa.2021.101915
Type	Journal article
Published in	International Review of Financial Analysis
Published by	Elsevier BV
ISSN	1057-5219
Subjects	Economics and Econometrics; Finance
Links	https://api.elsevier.com/content/article/PII:S1057521921002416?httpAccept=text/xml; https://api.elsevier.com/content/article/PII:S1057521921002416?httpAccept=text/plain

99. doi:10.1016/j.ijforecast.2021.11.001

Title: Forecasting: theory and practice

Authors: Fotios Petropoulos, Daniele Apiletti, Vassilios Assimakopoulos, Mohamed Zied Babai, Devon K. Barrow, Souhaib Ben Taieb, Christoph Bergmeir, Ricardo J. Bessa, Jakub Bijak, John E. Boylan, Jethro Browell, Claudio Carnevale, Jennifer L. Castle, Pasquale Cirillo, Michael P. Clements, Clara Cordeiro, Fernando Luiz Cyrino Oliveira, Shari De Baets, Alexander Dokumentov, Joanne Ellison, Piotr Fiszeder, Philip Hans Franses, David T. Frazier, Michael Gilliland, M. Sinan Gönül, Paul Goodwin, Luigi Grossi, Yael Grushka-Cockayne, Mariangela Guidolin, Massimo Guidolin, Ulrich Gunter, Xiaojia Guo, Renato Guseo, Nigel Harvey, David F. Hendry, Ross Hollyman, Tim Januschowski, Jooyoung Jeon, Victor Richmond R. Jose, Yanfei Kang, Anne B. Koehler, Stephan Kolassa, Nikolaos Kourentzes, Sonia Leva, Feng Li, Konstantia Litsiou, Spyros Makridakis, Gael M. Martin, Andrew B. Martinez, Sheik Meeran, Theodore Modis, Konstantinos Nikolopoulos, Dilek Önkal, Alessia Paccagnini, Anastasios Panagiotelis, Ioannis Panapakidis, Jose M. Pavía, Manuela Pedio, Diego J. Pedregal, Pierre Pinson, Patrícia Ramos, David E. Rapach, J. James Reade, Bahman Rostami-Tabar, Michał Rubaszek, Georgios Sermpinis, Han Lin Shang, Evangelos Spiliotis, Aris A. Syntetos, Priyanga Dilini Talagala, Thiyanga S. Talagala, Len Tashman, Dimitrios Thomakos, Thordis Thorarinsdottir, Ezio Todini, Juan Ramón Trapero Arenas, Xiaoqian Wang, Robert L. Winkler, Alisa Yusupova, Florian Ziel

Title of the periodical: International Journal of Forecasting

Volume 38, Issue 3

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Pages 705-871

Co-authored Action publications - other

1. doi:10.2139/ssrn.4209433

Title	A Data-driven Case-based Reasoning in Bankruptcy Prediction

Authors	Wei Li; Wolfgang K. Härdle; Stefan Lessmann
DOI	doi:10.2139/ssrn.4209433
Type	Journal article
Published in	SSRN Electronic Journal
Published by	Elsevier BV
ISSN	1556-5068
Subjects	General Earth and Planetary Sciences; General Environmental Science

Proposals/ projects

The Action reported 10 project(s) and 10 proposal(s) resulting from the Action networking.

Key details of the projects are shown below:

1. Crypto Currencies and Nordic Youth
   (Trans-national - This research has been provided via an academia-industry collaboration with Nasdaq.)
2. Network-based credit risk models on P2p lending markets
   (Trans-national - The research is jointly supported by the Czech Science Foundation and SNSF Lead Agency.)
3. Blockchain and Fraud Detection
   (Trans-national - SNF)
4. Network-based credit risk models on P2P lending markets
   (Trans-national - SNSF Lead Agency)
5. Digital Finance and Reinforcement Learning
   (National)
6. Narrative Digital Finance: a tale of structural breaks, bubbles & market narratives
   (National)
7. Blockchain
   (National)
8. DataInc - Intelligent Data Integration and Cleaning
   (National)
9. IRTG 1792 extension 2022.10-2023.3
   (National)
10. XAI in credit risk management
    (National)

Other outputs / achievements

The following other outputs/ achievements contributing to the COST mission resulted from the Action:

1. The Croatian team gave a contribution to the organisation of a COST FinAI event – International Scientific Conference Technology, Innovation and Stability: New Directions in Finance (TINFIN), May 5-6, 2022:

   The Conference, held in Zagreb and online, was organised by the Faculty of Economics and Business of the University of Zagreb, Croatian Academy of Sciences and Arts and COST Action - Fintech and Artificial Intelligence in Finance - Towards a Transparent Financial Industry. The Programme Committee and the Organising Committee of the Conference was formed dominantly by COST FinAI Action's participants, where special attention was payed to diversity regarding their gender and experience as well as inclusion of ITC. The event was devoted to topics of current challenges for the financial industry, focusing on fintech and artificial intelligence in finance, and the participants interested in more traditional framework of finance and economics also found their place. The event hosted several different activities, including:

keynote session titled "Manifold destiny: Unsupervised machine learning for the social sciences" by professor James Ming Chen, Michigan State University, College of Law, USA;
COST session with invited talk on "Overview of COST Action CA19130 FinAI - Fintech and Artificial Intelligence in Finance - Towards a Transparent Financial Industry" by the Action Chair – professor Jörg Osterrieder, Zurich University of Applied Sciences - ZHAW, School of Engineering, Switzerland / Bern Business School, Institute of Applied Data Science and Finance, Switzerland;
meeting of the COST FinAI WG 2 with research presentations of WG 2 members;
additional parallel tracks of research presentations of other authors; and
panel discussion titled „FinTech in 2022 and beyond: Possibilities and new regulatory challenges“, gathering various stakeholders in the FinTech field, including industry professionals and regulators.
The Conference hosted around 60 participants, coming from over 15 countries. Conference proceedings are planned to be published.

2. Organised WG1 meeting at Rennes School of Business jointly with the Crypto-currency investment conference (April 2022) contributed to mutual knowledge exchange and knowledge dissemination as well as to a network extension and launching new projects.

3. Maria Moloney has been accepted onto the CEDPO AI WG, (Working Group for Artificial Intelligence of the Confederation of European Data Protection Organisations) based in Brussels. We will be working on advising policy regarding AI from the perspective of data protection.

4. We have expanded substantially our academic base on quantlet.com, founded by WG1 leader, Prof Härdle, HU Berlin. This is the foundation of hundreds of academic papers.

5. We have founded quantinar.com, WG1 leader, Prof Härdle, HU Berlin. This is the foundation of a substantial number of data sources, academic training and teaching materials and research dissemination.

6. We build up a research and development (R&D) relationship with the OTP, the largest Hungarian retail bank, in the area of financial services technologies that could involve a number of different research initiatives and activities. Some potential areas of focus could include:

   - Blockchain application in financial business processes: This could involve researching and developing ways in which blockchain technology can be used to streamline and improve various financial processes, such as payments, clearing, and settlement.

   - NFT (non-fungible token): This could involve researching and developing ways in which NFTs can be used to represent and trade digital assets, such as art, collectibles, and virtual real estate. Digital money, currencies, assets: This could involve researching and developing ways to use digital currencies and assets in financial transactions, including the use of central bank digital currencies (CBDCs) and stablecoins.

   - Participating as members in the Hungarian Blockchain coalition: This involves joining a group of industry participants working together to advance the use of blockchain technology in Hungary, through the logistics workgroup, legal group and financial institutions group.

7. Condruta Mare, Alessandra Tanda, and Vasil Strat conceptualized a strategy for engaging stakeholders in the COST Action AI in Finance research network under consideration of the input from various COST members. The authors created a strategy based on the following building blocks:

   Identifying key stakeholders: Under the premise of engaging with stakeholders, it is important to

identify who they are and what their interests and concerns are. This involved identifying relevant industry associations, financial regulators, academics, and other organizations involved in AI and finance with a European country focus.
Building relationships: Once key stakeholders have been identified, the strategy considers subsequent steps to build relationships. This involved reaching out to stakeholders directly and inviting them to participate in the network's activities and events, such as workshops, conferences, and webinars.
Communication and Transparency: Considerable emphasis was placed on open communication by providing regular updates on the network's activities and progress, as well as sharing research findings and publications. A central objective is to encourage stakeholders to ask questions and provide feedback.
Creating opportunities for collaboration: Creating opportunities for stakeholders to collaborate on research projects, pilot studies, and other activities was considered a crucial strategic pillar. This could include providing funding or other resources to support joint projects, or creating a platform where stakeholders can share data and collaborate on research.

8. Luisa Anderloni and Alessandra Tanda cooperated with other COST Action members from different EU countries to retrieve credit information on P2P lending platforms. In a first attempt, a process was developed to collect information on the portfolio of a platform. The following steps were executed:

   Gather publicly available information: Initial data on a P2P lending platform was gathered by focusing on any publicly available information. This included information on the platform's website, such as loan origination statistics, default rates, and performance metrics. Other sources of publicly available information included regulatory filings, press releases, and financial reports.
   Analyze loan data: In the following step, the collected publicly available information was analyzed to obtain preliminary insights into the loan data provided by the platform. The information accounted for loan amounts, interest rates, loan terms, borrower credit scores, and other metrics. Thereafter, it was further analyzed how the portfolio composition and diversification; the loan distribution across different loan types, terms, credit scores, and geographies differed across the sample.
   Compare with industry data: The insights from the analysis were then compared with information from industry data; this information included average interest rates, default rates, loan terms, and other metrics for P2P lending platforms.
   Perform due diligence: Once the information has been collected and analyzed, it is possible to perform due diligence on the platform. This will involve assessing the platform's risk management practices, its financial position, and its regulatory compliance.

9. Marcin Chlebus delivered a research seminar with the topic "XAI Tools in Model Selection for Business Decision Modeling" and discussed the use of explainable artificial intelligence (XAI) tools in the context of business decision modeling. XAI is a field of AI research that aims to develop algorithms and methods that can provide explanations for the decisions made by AI systems. In the context of business decision modeling, XAI tools are used to improve the transparency and interpretability of financial models, and to facilitate the model selection process.
   The seminar covered several key topics, including:
   - The limitations of traditional AI models, which may be opaque and difficult to interpret,
   - The benefits of using XAI tools in business decision modeling, such as improved transparency and accountability,
   - The impact of XAI on the model selection process is that it provides better understanding of the model's performance, its predictions, and its ability to generalize.
   - Practical examples of how XAI tools are being used in industry for business decision modeling, such as fraud detection, credit risk assessment, and algorithmic trading.
   Furthermore, the seminar discovered significant practical examples of how XAI tools may not only improve transparency for financial models, but also impact the model selection process itself. These examples included, but were not limited to:
   - Fraud detection, in which XAI can provide explanations for why a transaction was flagged as potentially fraudulent, allowing analysts to make more informed decisions about whether to pursue further investigation.
   - Credit risk assessment, where XAI can provide insights into the factors that are most important in

determining a borrower's creditworthiness. - Algorithmic trading, in which XAI can explain why a particular trade was executed, allowing traders to make more informed decisions about which trades to execute in the future and improve risk management processes.

10. We constructed an ICO database as part of the published work from the COST Action members Karimov Bedil and Wójcik Piotr (2021), (https://doi.org/10.3389/frai.2021.718450). The ICO database was constructed as a comprehensive and user-friendly tool for researchers in order to enhance future research efforts in the area.

    The database includes public information on the respective ICO, such as the name, the date it was conducted, the amount of money raised, the tokens being sold, and the team behind the ICO. To construct the database, the following steps were taken:

    Data gathering: Data was collected on all the ICOs that have been conducted or are currently in the process of being conducted. The information included the name of the ICO, the date it was conducted, the amount of money raised, the tokens being sold, and the team behind the ICO.

    Data organization: The data was organized into a logical format that is easy to navigate. This included creating categories for different types of information, such as date, amount raised, and team.

    Database creation: The database management system, was based on MySQL to adequately store the collected data. This will allow for easy searching and filtering of the data.

    Database population: The collected data was inserted by several COST members into the database and checked for accuracy and consistency.

    User interface creation: The user interface was designed to include a search function and the ability to filter the data by different categories in order to make it appealing for users to quickly navigate within the tool.

    Update procedures: Regular updates of the database with new ICOs are conducted to ensure that the data remains accurate and up-to-date.

11. Alessandra Tanda currently leads an interactive database project with several COST Action researchers from Portugal to collect and organize information on the past fees and price performance of the most traded ETFs in Europe. The project is currently in the development phase, with a focus on using text mining techniques to extract information from Key Investor Information Documents (KIIDs) of European ETFs. This information includes details about the ETF's performance, fees, and risks, which will be used to create a comprehensive database of European ETFs. Once completed, the database will be made available to COST Action members. This will provide researchers with an easy-to-use resource for researching and investing in European ETFs. The database will be regularly updated with new ETFs as they become available, and it will be accessible online for easy searching and filtering of the data. Overall, the goal is to create a valuable resource for researchers and investors interested in the European ETF market, providing them with a wealth of information on the past performance and fees of the most traded ETFs in Europe.

12. Jeric Vlah led two research seminars at two independent COST Action FinAI events named the 29th Symposium of the Society for Nonlinear Dynamics & Econometrics and conference event "Technology, Innovation and Stability: New Directions in Finance (TINFIN)", Zagreb, Croatia with a focus on investigating time interval choices in technical indicator-based stock price forecasting. His research work discussed the effect of time interval choices on the accuracy of technical indicator-based stock price forecasting. The seminar presentation covered the following key points:

    - Introduction to technical indicators and their importance in stock price forecasting
    - The problem of time interval choices and its impact on the accuracy of technical indicator-based predictions

- Description of the dataset and methods used in the study
- Results of the study and its comparison with other time intervals
- Implications and recommendations for practitioners
- Conclusion and future work

The author outlined the use of a large dataset of historical stock prices and technical indicators that were calculated at different time intervals. Various machine learning algorithms were then used to predict the direction of stock price changes using the technical indicators as input parameters. The performance of the predictions was subsequently evaluated using metrics such as accuracy, precision, and recall indicators. The results of the study indicate that the choice of time interval can have a significant impact on the accuracy of the predictions and that the optimal time interval depends on the specific stock and the technical indicator used. The study concludes that the choice of time interval is an important aspect to consider in technical indicator-based stock price forecasting.

13. A. Ivanisevic Hernaus, J. Kristo, and R. Rako gave a research seminar on the topic "ESG-Related Challenges in the Insurance Industry: A Multi-stakeholder Perspective" at the COST Action FinAI event "Technology, Innovation, and Stability: New Directions in Finance (TINFIN)" in Zagreb, Croatia. The seminar presentation scientifically outlined the challenges faced by the insurance industry in integrating environmental, social, and governance (ESG) factors into their operations and investment decisions. With increasing public and regulatory awareness, insurance companies are facing pressure to align their strategies and activities with sustainable development goals. The authors adopt a multi-stakeholder approach to examine the challenges faced by insurers, policyholders, and regulators in integrating ESG considerations. It was also analyzed what the current state of ESG integration in the insurance industry is, the drivers and barriers to this integration, and the potential solutions for addressing these challenges.

    The research presentation covered the following key points:

    - Overview of ESG and its importance in the insurance industry
    - Examination of the current state of ESG integration in the insurance industry
    - Analysis of the challenges faced by insurers, policyholders, and regulators in integrating ESG
    - Identification of drivers and barriers for ESG integration in the insurance industry
    - Discussion of potential solutions for addressing the challenges and recommendations for the industry

14. P. Dzelalija and A. Ivanisevic Hernaus presented a research paper with the title "From perceived mobility to the intention to use mobile payments: A moderated mediation analysis" at the COST Action FinAI supported event FinanceCom 2022: International Workshop Enterprise Applications, Markets, and Services in the Finance Industry, University of Twente, the Netherlands. The presentation described factors that influence consumers' intention to use mobile payments. The study adopted a multi-disciplinary approach by combining theories from information systems, marketing, and psychology to explore how perceived mobility and trust, influence the intention to use mobile payments. A moderated mediation analysis was discussed, to examine the direct and indirect effects of perceived mobility and trust on the intention to use mobile payments. In addition, the research examined the moderating effect of demographic factors such as age and gender on the relationship between perceived mobility, trust, and the intention to use mobile payments. Thereby, the study aimed to facilitate the understanding of the complex relationships among the factors being studied, and also provide further insight into the aspects that influence the intention to use mobile payments.

    The presentation covered the following key points:

    - Introduction and background on mobile payments and its increasing importance
    - Theoretical framework: an overview of perceived mobility, trust, and their relationship with the intention to use mobile payments
    - Research design and methods, including data collection, analysis techniques, and sample characteristics

- Results and findings: examination of the direct and indirect effects of perceived mobility, trust, and demographic factors on the intention to use mobile payments
- Implications and recommendations for practitioners, policymakers, and researchers.
- Conclusion and future work.

15. Branka Hadji Misheva designed, as part of the research work for the COST Action FinAI, an explainable webpage (explainableaiforfinance.com) on visual analytics (VA) tools tailored to financial applications. This webpage provides information and proposes VA tools that include several key features to make them useful for both model developers and evaluators. For model developers, the VA tools include interactive visualizations that allow them to explore and analyze the data used to train their models. Visualizations such as scatter plots, heat maps, and decision trees are recommended to help interested programmers understand the relationships and patterns in the data. Additionally, the tools also include interactive controls that allow the developers to explore different aspects of the data, such as filtering by certain variables or changing the granularity of the analysis.

    On the other hand, for model evaluators, the VA tools also offer visualizations that provide transparency into the inner workings of the models, such as feature importance plots and partial dependence plots. These types of visualizations support evaluators in understanding how the model is making its predictions and identifying any potential issues or biases in the model.

    Furthermore, the description of VA tools was also expanded to include a section for evaluating the performance of the models, such as accuracy and AUC-ROC plots, which assist evaluators to better understand how well the model is performing and identify any areas where improvements could be made. In this context, the webpage also provides detailed information about the feature importances, like variable importance and variable interactions, that help understand what the most important features are in a dataset.

16. Jörg Osterrieder provided a presentation as part of a panel on the digital transformation of the EU's financial markets at the 11th European Financial Regulation Conference in Brussels in October 2022. The presentation was data-driven and provided facts and figures to back up the statements, including the benefits and drawbacks of the digital transformation and the expected impact on consumers and the market as a whole. It also addressed the role of the EU and its regulators in shaping the digital financial landscape and ways to ensure the protection of consumers while promoting innovation.

    In total, the talk covered a wide range of topics related to the use of technology in the European financial sector. The general outline for the presentation covered the following points:

    - Introduction and overview: The panel addressed the current state of the digital transformation within the EU's financial markets and the importance of the topic to the conference.

    - Overview of the EU's digital landscape: Focus on a high-level overview of the EU's current digital landscape in the financial sector, including the current state of technology adoption and the regulatory environment.

    - Case studies of digital transformation in action: Specific examples were presented of how different financial institutions in the EU have implemented digital transformation. It was highlighted which cases provided insights into the digital transformation's successes, challenges, and lessons learned.

    - The role of technology in financial regulation: A specific focus was placed on the investigation of how technology is impacting financial regulation and the implications for regulatory bodies. The presenters discussed some of the emerging technologies and the ways in which they are transforming the financial sector.

    - Panel discussion: Subsequently, the floor was opened for a panel discussion, where attendees had the opportunity to ask questions and engage in a dialogue with the presentors about the topics covered in the presentation.

- Conclusion: The key takeaways from the presentations were summarized, and the sessions were closed by highlighting some of the key challenges and opportunities that lie ahead for the EU's effort to digitally transform its financial markets.

17. Several scholars from the COST Action FinAI, among them Wolfgang Härdle, Vasile Strat, and Alla Petukhina, founded the Blockchain Research Center (BRC) (blockchain-research-center.com) together with other international researchers from leading European universities. The BRC is an organization that aims to promote the study and use of blockchain technology in a variety of applications, including financial services. The BRC aims to support the growth of the blockchain industry by providing a range of tools to researchers, companies, and financial institutions. Some of the key services the BRC provides include:

    - Customized independent solutions: The BRC provides bespoke solutions that are tailored to the specific needs of its clients.

    - Scientific support: The BRC offers scientific support to its clients to help them understand and apply blockchain technology in their research or business operations.

    - High-level academic lectures: The organization of lectures and other educational events by the BRC help to promote the understanding of blockchain technology among researchers and industry professionals.

    - Globally intertwined blockchain forums: The BRC hosts forums and other networking events to promote academic exchange and commercial cooperation among blockchain researchers and industry practitioners.

    In order to provide these services, the BRC relies on a team of experts with a wide range of skills and experience in academia, finance, law, investment, and blockchain. This diverse background enables the institute to provide clients with a comprehensive range of services that will help drive academic and industrial development in the blockchain field.

Impacts

The Action reported the following impact(s):

Description of the impact, i.e. what will change, and for whom, as a result of what the Action achieved	Type of impact	Timing of impact
The COST Action FinAI was also involved, with the support of several members, in the establishment of the EIT Digital Summer School on Artificial Intelligence in Financial Services (https://summerschool.eitdigital.eu/artificial-intelligence-in-financial-services). The program focuses on the intersection of artificial intelligence and financial services and covers topics such as machine learning, deep learning, natural language processing, and its applications in finance. Students were aimed at being provided with a deep understanding of the digital financial landscape and how artificial intelligence is changing it, while also achieving the necessary skills to become successful entrepreneurs in the field. The program is organized in a way that combines lectures, workshops, and hands-on experience with real-world projects, allowing students to apply the concepts they have learned in a practical context. The program also includes guest lectures from leading experts in the field, as well as visits to financial institutions and startups to learn about the latest trends and developments in the field. The COST Action FinAI also contributed to the EIT Digital Summer School on Disrupting Finance by Digital Technologies (https://summerschool.eitdigital.eu/disrupting-finance-with-digital-technologies). The specifically developed program focuses on the intersection of finance and digital technologies and covers topics such as blockchain, digital currencies, digital identity, and its applications in finance. The program is organized interactively through lectures, workshops, and hands-on experience with real-world projects, allowing students to apply the concepts they have learned in a practical setting as well. Guest lectures as well as on-site visits to financial institutions and start-ups were also incorporated to provide students with the latest trends and developments in the field. Overall, the EIT Digital Summer School programs provide students with an intensive and immersive experience in a specific area of digital technology. Both summer schools also provide opportunities for students to work on projects, participate in competitions and hackathons, and engage with a wide range of stakeholders, including top European corporations, SMEs, startups, universities, and research institutes.	• Scientific / Technological • Economic • Societal	Achieved
The objective of the VMG is to support collaboration and the exchange of ideas, data, methods, and other resources among researchers in order to increase the visibility and awareness of the COST Action and in the same time to support the advancement of the research in the fields covered by the Action. The supported VMG have also ensured that the research outcomes and their results have wider applicability and dissemination inside and outside the network. The supported VMG have also ensured that the research outcomes and their results are more broadly applicable and disseminated within and beyond the network. By increasing the visibility of the Action members' activities and the results they have achieved, the VMGs will also contribute to the Action's increased impact. Thus, the Virtual Mobility Grants have contributed to a large array of sub-topics of the COST Action contributing mainly to the increase of the awareness of the Action. Among the 12 virtual mobility grants supported during the second grant period 3 have directly contributed to deliverables of the	• Scientific / Technological • Economic • Societal	Achieved

Action and 9 have touched on topics ranging from involvement of females in FinTech to creation of video materials for facilitating the understanding of various data science and AI topics. Belma's VMG performed a bibliometric review on the topic of Venture Capital (VC) in order to improve the understanding of the VC environment that contributes strongly to the development and success of the FinTech industry. Alessandra's VMG proposed a survey to investigate basic perceived knowledge of FinTech innovations and of STEM and mathematical aptitude for different demographics. Wolfgang's VMG has improved the library of the Quantinar platform. Ioana's VMG has investigated the challenges of FinTech from both a regulatory and technology point of view. Codruta's VMG has supported the realization of the first FinTech report for Romania providing an overview of the sector. Maria's VMG focused on financial inclusion and on analyzing FinTech gender diversity in different EU countries. Barbara's VMG proposed an analysis of the gender and social connectedness of the editorial boards of finance journals. Shala's VMG supported the Datathon initiative developed in our Action bringing together students, academics and industry representatives around FinTech and AI topics. Esra's VMG analyzed the relationship between cashless economy and green growth within the framework of FinTech.		
The STSM (Short Term Scientific Mission) grant, developed by the COST Action FinAI is a program designed to encourage collaboration and the exchange of ideas, data, methods, and other resources among researchers in order to further advance research in specific fields. It helps to ensure that research outcomes are more widely applicable and widely disseminated throughout Europe, leading to more impactful outcomes. The grant has been significant in increasing international collaboration, publications, and result dissemination, and the quality of research outcomes has been increasing. The recent STSM grants have contributed to several specific research areas, such as the development of new algorithmic tools for anomaly detection in stock markets. This research, led by Apostolos Chalkis, contributes to a better understanding of risks and their causes in portfolio optimization, and also stimulates long-term scientific collaboration among universities and research institutions. Additionally, the computational tools developed as part of this research have been implemented in open-source packages, making them widely available to researchers and practitioners. Another recent STSM grant led to the development of efficient geometric and computational tools based on semidefinite programming and random walks for studying Bayesian inference of systemic risk interlinkages. This research, led by Elias Tsigaridas, introduces advanced geometric, algebraic, algorithmic, and computational tools in computational finance and develops highly efficient mathematical software for various tasks, with the long-term goal of tackling problems that are currently intractable with available techniques. A prototype implementation in MATLAB with the corresponding algorithms has been developed. Lastly, the STSM grant was used to evaluate sustainability goals at the European level from a spatial perspective using taxpayers' perception and sentiment analysis. This research, led by Coita Ioana-Florina and Belbe Stefana, contributes to structuring the research topic, methodology and extending the database of evaluations of sustainability goals at the European level from a spatial perspective using taxpayers' perceptions and sentiment analysis. This research aims at assessing sustainability at the institutional level in the financial domain using AI models that support transparency and help authorities discover fraudulent activities in a more efficient manner.	• Scientific / Technological • Economic • Societal	Achieved

The COST Action FinAI, represented by its member Dolores Romeo Morales, co-organized the online seminar series "Machine Learning NeEDS Mathematical Optimization" (https://congreso.us.es/mlneedsmo/) with Emilio Carrizosa from IMUS-Instituto de Matemáticas de la Universidad de Sevilla, in collaboration with PhD Students Kseniia Kurishchenko from CBS, Cristina Molero Rio from IMUS, Jasone Ramrez-Ayerbe from IMUS, and Thomas Halskov from CBS. The seminar series is designed to provide an impactful platform for leading academics in the field of data science and analytics to share their latest research findings and developments, with a focus on the integration of machine learning and mathematical optimization. The seminar series includes a number of presentations from experts in the field who will cover important topics such as explainability, fairness, fraud, privacy, etc. Mathematical modeling and mathematical optimization will be at the core of their presentations. Additionally, the seminar series includes a YOUNG online seminar series on "Machine Learning NeEDS Mathematical Optimization", where in each session, three junior academics will show their latest results in this burgeoning area. The format of the seminar series is a weekly session that will take place every Monday at 16.30 (CET), starting on January 11, 2021. The seminar series is 100% online, and it will have speakers from around the globe. The seminar series is free thanks to the funding the EU gives to the H2020 MSCA NeEDS project, as well as the support given by IMUS-Instituto de Matemáticas de la Universidad de Sevilla. Shortly after each seminar, its video recording will be available at both the IMUS YouTube channel, as well as the NeEDS YouTube channel.	• Scientific / Technological • Economic • Societal	Achieved
Dolores Romeo Morales, as member of the COST Action FinAI, is a member of the conference organization committee of the European Conference on Operational Research (EURO) 2024) (https://euro2024cph.dk), which will take place in Copenhagen, Denmark, from June 30 to July 4, 2024. The event is a well-established conference that covers a wide range of topics within the field of operational research, including: mathematical modeling, optimization, decision support systems, simulation, logistics and transportation, production management, finance and economics, and many others. The conference will likely feature keynote speeches, panel discussions, and paper presentations given by leading experts in the field. The topics presented in the conference will likely include recent advances and challenges in the field of operational research, as well as the potential applications and implications of these developments in various industries and domains. As a member of the conference organization committee for EURO 2024, Dolores Romeo Morales supported the conference committee in the following aspects: Helping to plan and organize the conference, including determining the theme and format of the conference, selecting keynote speakers, and planning the scientific program. Recruiting attendees and presenters, by reaching out to researchers and academics in the field of operational research and encouraging them to submit papers, make proposals, or attend the conference. Assisting in the selection of paper submissions and presentations, and ensuring that the conference's scientific program is of high quality and covers a broad range of topics within the field of	• Scientific / Technological • Economic • Societal	Achieved

operational research.		
The organization of the workshop "Making Sense of Interpretable Machine Learning" was a collaborative effort between the COST Action FinAI and the Lorentz Center in Leiden, the Netherlands. The workshop was held on October 17–21, 2022, and was localized at the Lorentz Center. The event was also a part of the stream on machine learning and mathematical optimization at EURO2022, which was held in Espoo, Finland, on July 3–6, 2022 (https://euro2022espoo.com/). The workshop was designed to provide a platform for experts in the field of interpretable machine learning to share their latest research findings and developments. To achieve this goal, the workshop consisted of 24 sessions, comprising a total of 95 presentations delivered by leading researchers in the field. These sessions were carefully curated to encompass a diverse range of topics related to interpretable machine learning, thus catering to the interests of a wide audience. As a result, the participants got valuable insights into cutting-edge research in the field of interpretable machine learning and had the opportunity to network with experts in the field. Additionally, the variety of topics covered allowed participants to broaden their understanding of interpretable machine learning and its applications. The selection of speakers for the workshop was done based on the evaluation of their expertise, research contributions, and relevance to the workshop's theme. The organizing team took care of promoting the workshop through various channels, such as the COST FinAI meet-up group, email, and the workshop's official website. The overall goal of the workshop was to create an intellectually stimulating environment where attendees could learn, share, and network with their peers.	• Scientific / Technological • Economic • Societal	Achieved
The COST Action FinAI country team from Croatia around Ana Ivanisevic Hernaus actively contributed to the organization of the EURO PhD School "Data Driven Decision Making and Optimization" (https://congreso.us.es/epsdata/), a doctoral training school organized by the IMUS-Mathematical Institute of the University of Seville, Spain. The school was scheduled to take place from June 13–22, 2022, and was delivered to 26 students. 21 invited speakers from academia and industry joined the event. The school was organized to provide students with in-depth knowledge and understanding of the latest research and developments in the fields of data-driven decision making and optimization. The program covered a wide range of topics, including mathematical modeling, machine learning, optimization techniques, and their applications in various fields, such as finance, healthcare, and engineering. A combination of lectures, workshops, and hands-on exercises were delivered by the invited speakers from academia and industry. The speakers shared their expertise and experiences with the students, providing them with a broad perspective on the research field. Additionally, the school also provided opportunities for students to interact with and learn from each other through group work and discussions. Opportunities were also provided for students to present their own research and receive feedback from the invited speakers and other attendees. In this sense, the school was designed to provide students with a comprehensive and in-depth understanding of the latest research and represented a valuable opportunity for PhD students and early-career researchers to learn from experts in the field, network with peers, and further develop their research skills.	• Scientific / Technological • Economic • Societal	Achieved

The COST Action CA19130 joins program committees, executive committees, and management committees for a series of events. These events include: Member of the Scientific Committee of ISMP 2024, Montreal (Canada), July 21-26, 2024. Member of the Program Committee of FinanceCom2022, University of Twente (The Netherlands), August 23-24, 2022. Chair of the Program Committee of EURO 2022, Espoo (Finland), July 3-6, 2022. Member of the Program Committee of EURO 2021, Athens (Greece), July 11-14, 2021. Selected keynote events are or will be attended: Keynote Speaker at IFORS2023, Santiago de Chile (Chile), July 10-14, 2023. Keynote Speaker at ISF2023, Charlottesville (Virginia), June 25-28, 2023. Plenary Speaker at the 19th Workshop on Advances in Continuous Optimization, EUROPT 2022, SST NOVA (Portugal), July 29-30, 2022. Plenary Speaker at International Conference on Optimization and Decision Science 2021 (ODS2021), 50th Annual Meeting of AIRO, Rome (Italy), September 14-17, 2021. Keynote Speaker at IEEE CASE 2021 on Data-Driven Automation, Lyon (France), August 23-27, 2021. Holding these events and providing keynote addresses increases the association's influence in many nations and the European Union. It allows academics, industry practitioners, and politicians to further trace the association's contribution to financial research. Moreover, more financial-related groups are willing to participate in association activities.	• Scientific / Technological • Economic • Societal	Achieved
The COST Action FinAI helped in the establishment of an internal research network, specifically focused on crypto-market studies. The new network aims to bring together technological, quantitative, and economic researchers from across Europe to tackle future research that requires an interdisciplinary setting. The network is actively involved in the blockchain and FinTech communities, and focuses on enhancing capacity building, the transfer of knowledge, and the inclusion of early-career investigators. The network achieves its goals by organizing conferences and seminars where researchers can share their findings and collaborate on new research. By bringing researchers from different disciplines and backgrounds together, the network aims to enhance the transfer of knowledge in terms of crypto-market expertise and scientific tools across different disciplines and between academia and industry. Furthermore, the network members aimed to establish an inclusive	• Scientific / Technological • Economic • Societal	Achieved

community of crypto researchers on methodological and technological themes. This includes involving early-career investigators and increasing their visibility in the field. Additionally, through the support of the COST Action FinAI, the network further enforces gender equality by actively aiming to involve female researchers in fintech and crypto studies. One example is the female scholar "Akanksha Jalan," who is actively contributing in the field.		
Realization of a short-term teaching visit within the Erasmus+ teaching mobility programme, of the Action's participant and WG 2 Co-leader – associate professor Kristina Sutiene, PhD (F, ITC) from Kaunas University of Technology, Department of Mathematical Modelling, Lithuania to the Action's partner University of Zagreb, Faculty of Economics and Business, Department of Mathematics (ITC), in the period of May 2-6, 2022. Delivered topics included: Applications of stochastic dominance in decision making (mainly theory and examples of applications) Network analysis of financial markets (theory + examples with R) The visit was an opportunity to widen teaching practice in an international setting, with a group of students specializing in the field of economics and business, as well as to strengthen the existing, up-to-then online only, networking and to discuss possible cooperation in the future period. From the point of view of the host university, students had an opportunity to advance their knowledge and the faculty members benefitted as well from new approaches to subject matter.	• Scientific / Technological • Economic • Societal	Achieved
Several members of the COST Action FinAI contributed to the EIT Digital's Master School on Digital Finance (FinTech) (https://masterschool.eitdigital.eu/fintech), where a two-year program focusing on the intersection of finance and technology was designed.The program covers topics such as digital finance, financial innovation, and FinTech entrepreneurship. The program was created to give students a deep understanding of the digital financial landscape, while also providing them with the skills they need to become successful entrepreneurs in the FinTech space. Reachout activities for the EIT Digital Master School on Digital Finance (FinTech) included the following: - Industry events and networking opportunities where students can connect with FinTech professionals and learn about the latest trends and developments in the field. - Guest lectures from leading FinTech experts and entrepreneurs share their insights and experiences with students. - Field trips to FinTech startups and financial institutions, where students can learn about the day-to-day operations of these organizations and gain insights into the FinTech ecosystem. Furthermore, the COST Action also contributed to the EIT Digital Master School on Data Science (https://masterschool.eitdigital.eu/data-science) and supported the establishment of a two-year program that focuses on the intersection of data science and technology. The program covers topics such as data science, machine learning, and data-driven entrepreneurship. It was aimed at giving students a deep understanding of the digital data landscape, while also providing them with the skills they need to become successful entrepreneurs in the data science space. Reachout activities for the EIT Digital Master School on Data Science included the following:	• Scientific / Technological • Economic • Societal	Achieved

- Industry events and networking opportunities where students can connect with data science professionals and learn about the latest trends and developments in the field. - Guest lectures from leading data science experts and entrepreneurs share their insights and experiences with students. - Field trips to data science startups and companies, where students can learn about the day-to-day operations of these organizations and gain insights into the data science ecosystem.		
Our research and knowledge dissemination platform, https://www.meetup.com/Fintech_AI_in_Finance/, has reached a substantial number of academics, professionals and the general public. With more than 150 events, more than 6000 participants and 2000 members, we have build a very large community around the topics of the COST Action CA19130.	• Scientific / Technological • Economic • Societal	Achieved
Several researchers received active promotions since the start of the Action, and the COST Action FinAI research network had a significant impact on their scientific output as well as their academic achievements: Simon Trimborn was promoted to assistant professor at the Amsterdam School of Economics, University of Amsterdam, in 2022 Wolfgang Karl Härdle was promoted to visiting scholar and YuShan scholar at the department of information management and finance at the National Yang Ming Chiao Tung University (NYCU) in 2022. Jörg Osterrieder was promoted to an associate professorship in the area of finance and artificial intelligence at the University of Twente in Enschede, the Netherlands. In addition, Jörg Osterrieder could initiate a new cooperation between the University of Twente and the ING Group, Global Analytics team on advanced quantitative, data-driven research projects, both relevant to academia and industry. Furthermore, Jörg Osterrieder was also appointed Professor of Sustainable Business at the Bern University of Applied Science in Bern, Switzerland. Branka Hadji Misheva was promoted to associate professor of applied data science and finance at the Bern University of Applied Science in Bern, Switzerland. Alla Petukhina was promoted to lecturer and researcher at the Hochschule für Technik und Wirtschaft Berlin (HTW) in 2021.	• Scientific / Technological • Economic • Societal	Achieved
Professor Tom Pilhal is currently undergoing the habilitation process in order to be promoted to the rank of Associate Professor. The committee and referees responsible for evaluating his qualifications have been primarily selected from within the COST Action. This indicates that his academic achievements have a strong connection to the research being conducted within the COST Action. Furthermore, he has also received financial support in the form of a Short-term Scientific Mission (STSM) grant. These factors demonstrate a clear alignment between Professor Pilhal's work and the objectives of the COST Action.	• Scientific / Technological • Economic • Societal	Achieved
Roman Matkovskyy's participation in the COST Action FinAI has been instrumental in shaping the trajectory of the Financial Market and Corporate Outcomes research center that he established and currently leads at Rennes School of Business. Through his involvement in the FinAI program, he was able to gain a deeper understanding of the financial industry and formulate a more	• Scientific / Technological • Economic • Societal	Achieved

comprehensive strategy for the center's research endeavors. Furthermore, his participation in the COST academy training “Understanding EU decision making process - how to advocate your interests”, has been beneficial for the development of a research project. The knowledge and skills acquired during the training have enabled him to create more finely-tuned research proposals, which have been submitted to various funding organizations with a higher likelihood of success. In other words, The combination of Roman Matkovskyy's participation in Cost actions FinAI and COST academy training has been a catalyst for the center's research output and funding opportunities.		
Barbara Będowska-Sójka's participation in the COST Action has been instrumental in securing funding from the Polish National Science Center (NCN) for her research project entitled “Properties of a cross-section of rates of return in the cryptocurrency markets” (NCN, nr 2021/41/B/HS4/02443). The funding competition placed a significant emphasis on participation in international projects, with 20% of the total points allocated towards this criterion. As such, the involvement in the COST Action played an important role in this success. The project is planned to last for a duration of 3 years, starting in January 2022, and has been allocated a budget of 483 212 PLN (approximately 100 euros). The focus of the project is to study the properties of the cross-section of rates of return in the cryptocurrency markets, which is an area of research that has seen increasing interest in recent years due to the growing popularity and importance of cryptocurrencies. By utilizing the opportunities and resources provided by the COST Action, the research project aims to make significant contributions to this field of study.	• Scientific / Technological • Economic • Societal	Achieved
Elias Tsigaridas, through his research project "Efficient geometric and computational tools based on semidefinite programming and random walks for studying Bayesian inference of systemic risk interlinkages," utilized the Short-Term Scientific Missions (STSM) program to further collaborate with the team of Dr. Veni Arakelian and Dr. Apostolos Chalkis in the field of computational finance. The focus of this collaboration was to explore advanced techniques for geometric, algebraic, algorithmic, and computational tools, and to use these tools to develop highly efficient mathematical software for various tasks. The ultimate goal of this research was to address problems related to systemic risk interlinkages which are currently considered intractable using traditional techniques. During this STSM visit, the team focused on the problem of efficient Bayesian inference for Gaussian copula regression models. They employed semidefinite programming (SDP) and random walk techniques, and specifically the M1 and M2 algorithms, to improve the computational efficiency of their solutions. They also implemented a prototype of their developed algorithm in the Matlab programming language. This work aimed to not only improve the understanding of the underlying models but also provide a general framework that can be applied to other similar problems in the field of computational finance.	• Scientific / Technological • Economic • Societal	Achieved

Dissemination and exploitation of Action results

Dissemination and exploitation approach of the Action

The Action's dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of Action results and the outcomes of these activities are described below.

1. Open access of research (working) papers; 2. Clearly stated expected results of the projects and the main advantages; 3. Participation in conferences/seminars/round tables etc. to disseminate the results; 4. Active networking and inviting more members to COST Actions; 5. Website and Newsletter: www.fin-ai.eu. The website is updated with all the information about the action (articles, conferences, opportunities). A monthly newsletter is sent to the subscribers. The website contains information about our action participants, and both conferences and new articles. For seminars, we prefer to use the Fin–ai Meet up; 6. Organization of monthly series of open seminars conducted by Data Science Lab (headed by Piotr Wójcik) in cooperation with Quantitative Finance Research Group – both in the Faculty of Economic Sciences University of Warsaw where research done within the COST action or related to applications of ML/AI in finance is presented. 7. Source code publicly available at quantlet.com 8. Data sets, training and research material made available at quantinar.com

Dissemination

Dissemination meetings funded by the Action (possible only until 31st October 2021)

The Action did not fund any Dissemination Meetings

Other dissemination activities

The Action also undertook the following dissemination activities:

Activity	Organizing the BlackSeaChain 2022 conference, which took place September 1–2, 2022, in Varna, Bulgaria. It covered topics such as: the present and future of the decentralized economy and finance; the challenges in front of regulation; an introduction to Web 3.0; new crypto wallets and their future; the new craze in the world of cryptocurrencies—NFTs; innovative solutions with smart contracts; and integrations between blockchain technologies, the IoT, and AI. The main organizer of BlackSeaChain 2022 is the company Quanterall, owned by COST action member Anton Andonov. Partners are LimeChain, Nexo, Ambire, INDUSTRIA Tech, Hack.bg, ReCheck, Bithope, Motion Software, and WeiChain.
Target	The target audience would be people from academia, industry, and practitioners in the field.
Outcome	We received multiple submissions, of which 43 were presented at the conference. The conference was organized as an in-person event on September 1–2, 2022, in Varna, Bulgaria.
Link	https://www.blackseachain.com/

Activity	Organization of a special session in the International Joint Conference on Neural Networks from the 18th of June to the 23rd of June 2023, hosted by the International Neural Networks Society with the title "Deep Learning for Financial Data Analysis." The session will likely feature presentations and discussions from experts in the fields of deep learning and financial data analysis who will share their research, insights, and perspectives on how deep learning techniques can be applied to analyze financial data. The session may also include demonstrations, interactive discussions, and opportunities for attendees to network with other researchers and practitioners in the field.
Target	The target audience would be researchers, practitioners, and academicians who are interested in the application of deep learning techniques to financial data analysis. This would include individuals from fields such as computer science, statistics, finance, and economics, who are working in academia, industry, or government.
Outcome	We received multiple submissions. The conference will be organized as a virtual conference.
Link	https://2023.ijcnn.org/

Activity	Organizing collaboration activities between the New Bulgarian University (NBU) and Management Financial Group (MFG), Bulgaria. MFG is a group of leading European companies that specialize in non-banking financial services. New Bulgarian University collaborates with MFG in a joint effort to solve some of the most challenging tasks in FinTech using state-of-the-art AI techniques. Students from the Master's program "Knowledge Discovery and Big Data Analytics" are heavily involved in the majority of these activities.
Target	The target audience would be academics, industry, and practitioners in this field.
Outcome	Topical tasks in the FinAI field were given to students of the Master's program "Knowledge Discovery and Big Data Analytics." It was negotiated to continue the collaboration to achieve several main goals: - provide internship opportunities to the best students; - participate in the upcoming Black Sea Chain 2023; - expand academic activities at NBU.
Link	https://managementfinancialgroup.com/

Activity	A workshop called "Environmental Finance for the Common Good." More details are summarized in the "Result" part.
Target	The target audience would be academics, industry, practitioners in this field, policymakers, and civil society.
Outcome	The workshop, co-organized by the Money, Macro, and Finance Society (UK) and the Department of Management, Birkbeck College, University of London, with the support of CA19130, saw a roundtable discussion on current challenges in environmental finance, open to the public. It acted as an evening public event featuring perspectives from industry, academia, and faith communities, and public lectures by Naoyuki Yoshino and Will Goodhart. Additionally, research papers were presented, and one was awarded the best paper by an ECI on fintech and AI topics.
Link	https://efcg2022.sciencesconf.org/

Activity	Workshop: Diversity Challenges and Opportunities in FinTech (NAPLES) The workshop aimed to bridge academics and policymakers by discussing the novel challenges and opportunities in FinTech and AI, particularly in STEM, to deal with diversity. Among the main contributions: "A first step towards financial inclusion: assessing the role of digital payments during the pandemic using single item latent trait response models" (A. Di Iorio (Bank of Italy), M. Iannario (University of Naples Federico II), A. Nobili (Bank of Italy), and G. Rocco (Bank of Italy).
Target	Academics, practitioners in this field, university students, and civil society.
Outcome	The following results were achieved: - Working paper presentation: The inclusion of explainable AI approaches for well-being: theory and applications (M. Hudec, University of Bratislava) - Working paper presentation: A Bayesian network approach to statistical measuring and prediction of gender gaps: P. Vicard (Roma Tre University), L. Giammei (Sapienza University), F. Mecatti (Milano Bicocca University), F. Musella (Link Campus University, Rome), and S. Romio (Milano Bicocca University). - Keynote speech: "AI: Why diversity matters for an inclusive future" (R. Johri, Head of R&D at HSBC and Founder of London Women in Machine Learning) - Seminar session: "Financial knowledge and the use of old and new financial instruments - M. Albanese (University of Naples Federico); V. Vitale (University of Naples Federico): Master students from the University of Naples Federico II presented the results of their research about the impact of gender stereotypes on the self-concept of female students in STEM. A technical session illustrated the latest research about financial inclusion and methods to improve diversity in FinTech, while the role of higher education in supporting diversity and allowing for inclusion in STEM fields was discussed during a round table. During the conference, a kick-off event for the "woman in fintech" datathon was also accomplished (https://fin-ai.eu/datathon/).
Link	https://fin-ai.eu/diversity-workshop-naples2022/

Activity	Organisation of the Lake of Como School as an educational event that focused on the topic of neural networks and nets applied to finance. The goal of the school was to provide attendees with an in-depth understanding of cutting-edge methodologies and the applications of these technologies in the field of finance. Participants are expected to attend the school, which provides them with an opportunity to gain knowledge and insights from experts in the field, and to expand their understanding of the latest trends and developments in this area. The school includes lectures, seminars, hands-on workshops, and

	opportunities for attendees to network with other researchers and practitioners in the field.
Target	The audience is primarily made up of PhD students and early-career researchers in this field.
Outcome	This summer school provided training for 25 young researchers, and successfully reached its aim.
Link	https://nnnf.lakecomoschool.org/

Activity	The International Fintech Research Conference from October 27–28, 2022, hosted by Politecnico di Milano and supported by the COST Action FinAI, brought together researchers in the field of Fintech from various areas such as banking, asset management, insurance, payments, capital markets, and the internet of things. The conference welcomed papers on a wide range of Fintech research topics, including theoretical analysis of finance and economics, machine learning applications to finance, cryptocurrencies, digital currency, cybersecurity, neural networks, smart contracts, peer-to-peer finance, big data analysis, nowcasting, text analysis in finance, blockchain technologies, network analysis in finance, and behavioral finance.
Target	The target audiences were researchers and industries in the respective field with a strong background in finance, economics, and computer science. Additionally, industry professionals and practitioners who were interested in the latest developments and research in the field of Fintech were also targeted by this conference.
Outcome	The conference received a total of 35 paper submissions, of which 24 were accepted for presentation at the conference. In addition to this accomplishment, the conference also served as an opportunity for researchers to submit their work for consideration in a special issue of Springer Digital Finance.
Link	https://www.fintechlab.it/fintech_conference2022/

Activity	The "Woman in Fintech Datathon" is an event organized by the Women in Fintech Conference Committee, in collaboration with the University of Tirana and the University of Naples Federico II with the support of the COST Action FinAI. The event is a data mining and analysis competition, with the goal of promoting the analysis of data related to the goals of the Women in Fintech Conference. The goal of the Datathon is to encourage the use of data analysis to understand and promote the goals of the conference and the field of Cost Action FinAI. The participating teams were from Albania, China, Germany, Ghana, Greece, Italy, India, Kosovo, Lithuania, and Romania.
Target	Master and/or PhD students in early stages of their career with an interest and background in data analysis, specifically in the field of Fintech and Artificial Intelligence in Finance. Female researchers working in the field of Fintech and Artificial Intelligence in Finance are especially targeted.
Outcome	The event attracted a total of 18 teams, comprising 46 participants, of whom 33% were male. The participants were tasked with utilizing quantitative approaches to produce written reports on the topic of financial inclusion. The reports were based on an analysis of data from the Global Findex database, maintained by the World Bank, with the goal of uncovering various financial characteristics of a global sample of individuals. The event aimed to provide valuable insights into the field of financial inclusion, utilizing a rigorous data-driven approach to generate meaningful results.
Link	https://fin-ai.eu/datathon/

Activity	Organisation of a special issue in the journal "Digital Finance." The issue aimed to explore the impact of new technologies on the financial industry, which is experiencing a significant disruptive moment referred to as the "fintech revolution." The journal invited submissions that use various research methods and theoretical frameworks to better understand the fintech phenomenon, with a focus on topics such as the use of artificial intelligence in finance, cryptoassets, blockchain technologies, smart contracts, and more. The special issue is in line with an "International Fintech Research Conference" that will be held in Milan in October 2022.
Target	The target audience is academics with a particular interest in finance, economics, computer science, and related fields.
Outcome	Issuance of a call for papers on the theme of fintech, specifically exploring the intersection of digital finance, emerging technologies, and innovative methodologies. Submissions were seeded that offer rigorous, in-depth examination of the various facets of the fintech landscape, including but not limited to topics such as: - The impact of digital technologies on financial service delivery and the customer experience - The emergence of new players and business models in the financial sector - The application

	of Artificial Intelligence and machine learning techniques to financial problem-solving - The analysis of cryptoassets as a new class of financial instruments - The implications of smart contract technology and decentralized finance - The use of big data analytics, nowcasting and text analysis in finance - The role of network analysis in understanding financial systems - The examination of behavioral finance in the digital age.
Link	https://www.springer.com/journal/42521/updates/23290068

Activity	Organization of a monthly series of open seminars conducted by the Data Science Lab (headed by Piotr Wójcik) in cooperation with the Quantitative Finance Research Group. Both organizational bodies are hosted in the Faculty of Economic Sciences at the University of Warsaw. The achieved research output was related to applications of machine learning and artificial intelligence in finance.
Target	The target audience would be for academics, industry, and practitioners in the field.
Outcome	Informing a wide audience about our COST action, increasing action visibility, and increasing understanding of XAI tools among financial practitioners (e.g., 2021-04-19: Chlebus Marcin, "XAI Tools as a Part of the Best Practices in Model Selection for Business Decision Modeling"); – related to MoU objectives 9 (Capacity Building 3), 10 (Capacity Building 4) and 15 (Capacity Building 9).
Link	https://qfrg.wne.uw.edu.pl/?p=1102

Exploitation activities

The Action undertook the following activities to ensure exploitation (use, in particular in a commercial context) of the Action's achievements:

Activity	Application of knowledge about specific XAI tools gained on WG2 seminars in daily business practice of Marcin Chlebus, vice CEO in Data Juice Lab, consulting company operating mainly in financial sector, application of XAI methods in FinTech projects in the area of Risk Modelling, Marketing campaigns, Human Resources and CRM. https://www.datajuicelab.com/
Target	Companies operating in Risk Modelling, Marketing campaigns, Human Resources and CRM
Outcome	Thanks to regularly organised COST action research seminars and meetings current knowledge about XAI in Finance has been acquired. The findings were effectively implemented in commercial projects. Usage of XAI methods led to the improvement of the quality of created models and to better understanding by business users of how the algorithms make decisions.

Activity	Development of Quantinar (Quantinar.com): Quantinar is a platform that focuses on providing data science education through a lecture-based approach, allowing learners to apply their skills through the execution of real-world projects. The platform is developed by several COST Action FinAI members, centered around Wolfgang Karl Härdle and his research team from Humboldt University Berlin. Researchers as well as students have the option to acquire course materials about statistical and programming-related tasks, including lecture material, mostly for free. The course-lets are designed according to different difficulty levels and provide a good starting point for students with non-technical backgrounds, as well as advanced training options for more experienced scholars.
Target	The target audience is aimed at research students as well as young researchers, but also accounts for more experienced scholars in terms of the variety of offered course-lets.
Outcome	The output of the platform resulted in a huge amount of open-access course-lets that span across the fields of machine learning, fintech, cryptocurrencies, data science, blockchain, and statistics.

Activity	Several members of the COST Action FinAI under the lead of Wolfgang Karl Härdle developed the platform Quantlet (www.quantlet.de): Quantlet is designed as a web-interface to freely exchange numerical methods, called Quantlets. Quantlet aims to introduce a centralized system that is constituted by documents from different scientific areas, submitted by various authors from professional researchers to university students. As part of the Collaborative Research Center, the Center for Applied Statistics and Economics and the International Research Training Group (IRTG) 1792, Quantlet contributes to the goal of strengthening and improving empirical economic research in Germany. At present Quantlet contains

	source code written mainly in: Python, R, C++, Solidity, Matlab, SAS
Target	The main target audience for Quantlet lies in researchers and academics who are interested to share and retrieve programming code for specific statistical use cases and model conceptualization.
Outcome	- Open access to all research and teaching related codes and programs, - Reproducibility of research results increases its accountability and reliability, - Full integration with GitHub, implemented with PyGithub package available on PyPI - Text Mining Pipeline providing Information Retrieval, document clustering and visualizations realized with a "GitHub API based Quantlet Mining infrastructure in R" - Ease of discovery and use of your technology and research results, everything in a single GitHub Markdown page - Standardized audit of your codes based on the StyleGuide

Activity	As part of the dissemination of the research output done within the COST Action FinAI and in order to further raise the attention on the scientific matter of investigating the use cases of artificial intelligence in finance, we also organized a meetup group (https://www.meetup.com/fintech_ai_in_finance/) that regularly updates all group participants with news on talks, seminal paper presentations, conference events, and working group meetings. The meetup-group currently circumvents around 2080 participants and provides the COST Action FinAI with an interactive platform to connect with researchers as well as interested individuals to discuss ongoing scholarly matters in the field of finance and AI.
Target	Interested scholars as well as private individuals are free to join the meet-up group and receive the latest notifications on the research output generated by the COST Action FinAI.
Outcome	Over hundreds of organized meet-up events including research seminars delivered by the core working groups WG1, WG2, and WG3 as well as interactive online break events have produced a rich community of interested and active scholars that regularly participate in the action.

Activity	The formation of the fintech community: fintech.mk (https://www.linkedin.com/company/fintech-mk?viewAsMember=true). This is the first fintech community in North Macedonia that intends to develop and facilitate the regional Fintech Ecosystem. It is a non-profit organization that provides IT and consulting services. The community routinely publishes fintech-related articles. Members of the Action from North Macedonia (Petre Lameski, Olivija Filipovska, Tatjana A. Pachemska, Eftim Zdravevski, Goran Petkovski, and Miroslav Mirchev) actively contributed to the website's construction and article writing.
Target	Researchers interested in Fintech, Financial Companies, Investors, and Readers who are curious about the application of AI in Finance.
Outcome	The community routinely publishes Fintech-related articles at: https://fintech-mk.medium.com. Currently, the community has 28 members and has authored thirteen articles in English and Macedonian.

Action Expenditure

The table below shows the budget allocated to the Action for each Grant Period (funds allocated for the first meeting of the Action and any Final Action Dissemination are not included):

#	Grant Period	Start Date	End Date	Budget allocated to Action (EUR)
1	AGA-CA19130-1	1-11-2020	31-10-2021	62,985.50 (EUR)
2	AGA-CA19130-2	1-11-2021	31-5-2022	202,607.00 (EUR)
3	AGA-CA19130-3	1-6-2022	31-10-2022	169,820.50 (EUR)
4	AGA-CA19130-4	1-11-2022	31-10-2023	257,925.91 (EUR)
5	AGA-CA19130-5	1-11-2023	13-9-2024	270,315.26 (EUR)