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EMbeDS

Economics and Management
in the era of Data Science

EMbeDS

**DEPARTMENT OF EXCELLENCE FOR ECONOMICS AND
MANAGEMENT IN THE ERA OF DATA SCIENCE**

ANNUAL REPORT 2020



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Summary Index

1. A BRIEF INTRODUCTION TO EMbeDS: A DEPARTMENT OF EXCELLENCE FOR ECONOMICS AND MANAGEMENT IN THE ERA OF DATA SCIENCE	3
2. HIGHER EDUCATION: PhD PROGRAMS ASSOCIATED WITH EMbeDS	4
3. EDUCATION AND RESEARCH-RELATED ACTIVITIES: VISITORS	5
4. EDUCATION AND RESEARCH-RELATED ACTIVITIES: WORKSHOPS AND MEETINGS RELATED TO EMbeDS	6
5. EDUCATION AND RESEARCH-RELATED ACTIVITIES: SELECTED ARTICLES, MANUSCRIPT AND CONFERENCES	7
6. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: INTERNAL AND EXTERNALLY FUNDED PROJECTS	14
7. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: AFFILIATIONS	19
8. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: NEW COURSES	20
9. INTERACTIONS AND AGREEMENTS WITH INSTITUTIONAL AND PRIVATE SECTOR PARTNERS	21
10. INFRASTRUCTURE: HIGH-PERFORMANCE COMPUTING CLUSTER	22
11. INFRASTRUCTURE: DATA BASE AND SOFTWARE ACQUISITION	24
12. RECRUITMENT: ASSOCIATE AND ASSISTANT PROFESSORS	24
13. RECRUITMENT: POSTDOCTORAL FELLOWS	25
14. MANAGEMENT, MONITORING AND PLANNING ACTIVITIES	26
15. ONLINE PRESENCE AND MEDIA COVERAGE	28



Department
of Excellence
2018 - 2022

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Economics and Management
in the era of Data Science

1. A BRIEF INTRODUCTION TO EMbeDS: A DEPARTMENT OF EXCELLENCE FOR ECONOMICS AND MANAGEMENT IN THE ERA OF DATA SCIENCE

EMbeDS is an acronym that, referring to a notion of embedding/inclusion, represents our overarching goal of exploiting opportunities fostered by Data Science (DS) in the disciplines of Economics (E) and Management (M) – leveraging data and tools to bridge the gaps that still exist between complex models, their empirical validation, and their use in policy. Within the path delineated by research funding and engagement initiatives at the Italian, European and United Nations levels, our scientific aim is to better understand the relationships between innovation, employment, growth, environmental and social sustainability. Our policy aim is to identify public- and private-sector strategies to manage socio-economic and environmental change, and the corresponding evolution of our welfare systems. These aims build upon four broad areas in which the Institutes of Economics and Management of the Sant'Anna School of Advanced Studies have a strong record of research, education and engagement with private and public institutions: (1) **Innovation and the 4th Industrial Revolution**; (2) **Industrial Dynamics, Competitiveness and Financial Markets**; (3) **Economies as Evolving Complex Systems**; (4) **Environmental and Social Sustainability** (with a particular focus on healthcare systems for the latter).

For each of these areas, opportunities and challenges afforded by contemporary big data are key. Data availability, as well as the possibility of integrating information from multiple sources, are rapidly growing. Exploiting these opportunities to spur major research progress requires sophisticated modeling approaches and state-of-the art statistical and computational tools to gather, integrate and analyze big data. Our groups pioneer many such approaches and tools. We work with young researchers in CoMoS (the Complexity Modellers' Society of the Institute of Economics) and participate to its CoMoS Climate Change (CCC) projects. We also have ties to the Quantitative Finance Group (Scuola Normale Superiore, Pisa) and the KDD Laboratory (CNR and University of Pisa). In addition, utilizing Big Data in many of EMbeDS areas requires care towards issues of intellectual property, as well as privacy, data protection and data safety; legal and ethical aspects related to these endeavors are part of the competences represented in the DIRPOLIS Institute of the Sant'Anna School, and in particular the Interdisciplinary Rights and Rules Laboratory LIDER-Lab – with a long tradition of theoretical and empirical legal research, training and consultancy in various fields of private law and regulation at national, transnational and international levels. Within the Sant'Anna School we also have ties to the Management and Health Laboratory (MeS Lab) of the Institute of Management and to the 3CSA Climate Change research center in the Institute of the Life Sciences (Prof. Buizza).

We have an established track record of translating research into measurable socio-economic impact through policies in support of innovation, growth and social mobility, environmentally sustainable production and consumption protocols, and effective and efficient healthcare systems. Finally, and importantly, we interact closely with the public and private sector on issues related to innovation, organizational change and new business models – with projects in the biomedical and healthcare sectors, the manufacturing sector, the banking and insurance sectors, and the manufacturing sector at large. We work with small and large companies, as well as a variety of institutional partners.

More information and details can be found at EMbeDS website: <http://embeds.santannapisa.it/>



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

2. HIGHER EDUCATION: PhD PROGRAMS ASSOCIATED WITH EMbeDS

We offer a [PhD in Economics](#) and a [PhD in Management](#) which enrolled, respectively, 5 and 13 students in 2020. Both doctoral programs have been classified as "innovative and international" by ANVUR. Doctoral theses produce high-profile international publications and the placement of our graduates is outstanding.

From 2017-18, we also offer a new [PhD in Data Science](#), which enrolls approximately 9-10 students every year. This doctoral program is a consortium with the Scuola Normale Superiore, the University of Pisa, CNR and the IMT of Lucca. It has been classified as both "innovative" and "interdisciplinary" by ANVUR, and it is part of an effort to increase interdisciplinary research through a focus on statistical and computational methods, and projects based on big data.

As in prior years, also in the 36th cycle (2020-21) EMbeDS supported three scholarships, one in each of the three PhD programs. This year's awardees are **Jacopo Cricchio**, PhD in Management, **Davide Luzzati**, PhD in Economics, and **Andrea Pugnana**, PhD in Data Science. (<https://www.embeds.santannapisa.it/news/three-new-phd-students-andrea-pugnana-davide-luzzati-and-jacopo-cricchio-join-embeds>).

The three PhD programs hold yearly meetings showcasing research by students and faculty. These meetings allow young researcher to receive input and feedback on their progress and promote collaboration and cross-fertilization among students and faculty of the programs. Due to the COVID-19 epidemic, the 2020 edition of the **Data Science Colloquium** took place online – with a series of talks between May 20th and June 8th (<https://www.embeds.santannapisa.it/news/data-science-colloquium-2020>). Also the **Data Science Ph.D. Day 2020** took place online on July 6th (<https://datasciencephd.eu/events/data-science-phd-day-2020>) – students described research spanning a variety of scientific and methodological questions (Privacy Protected Explanation, Exploiting the Latent Space of Machine Learning Models, Continual Learning with Recurrent Neural Networks, Data-driven methods for data center operations support, Structural and dynamical stability of real and reconstructed financial networks, Using big data to assess the direct and indirect impact of the COVID-19 epidemics on the Italian citizens' health and health system etc.). The **Economics PhD meeting** was held September 28-30th in mixed mode. During this event, students of the Sant'Anna-IUSS Joint Doctoral Program in Economics and guests from other institutions presented their work and received feedback from external experts and faculty members of the Institute of Economics. The program comprised 22 presentations tackling a variety of topics such as innovation, industrial dynamics, economic history, climate change, macroeconomics, statistics and finance. No meeting of the Management PhD was held in 2020. The three PhD programs also regularly provide opportunities for students to participate to a variety of external events, such as these attended by students in the Management PhD program: the **EHMA 2020** Annual Conference; the EURAM Conference 2020; the SIMA-SIM Summer School on research methodology; the Scuola Inter-Universitaria ("percorsi assistiti").

The placement of students graduating from the Economics and Management PhD programs in 2020 continued its tradition of success. **Three students graduated from the Economics program:** Irene Iodice is now a postdoctoral fellow at the Paris School of Economics; Elena Romito is now working at Banca d'Italia; and Matteo Coronese is now a postdoctoral fellow at the Institute of Economics of the Sant'Anna School. **Five students graduated from the Management Program:** Daniel Adrian Lungu, who is now a postdoc at Stavanger University; Francesca Pennucci, who is now a Research Fellow at MeS Laboratory of the Institute of Management at Sant'Anna; Shahabeddin Zare Bidaki, who is now is a postdoctoral fellow at the IMT School



Department
of Excellence
2018 - 2022

EMbeDS

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for Advanced Studies in Lucca; Fabio Iannone and Owais Ur Rehman Khan, who are now collaborators at Research Group SUM of the Institute of Management at Sant'Anna. Students from the **Data Science program** only recently started graduating; Gevorg Yeghikyan graduated in 2020 and moved to the KDD Lab on a postdoctoral position, but none of the Data Science students supported by EMbeDS graduated yet. We also note a Master thesis presented by Alessandro Marchesin titled *"Knowledge sharing and network dynamics in a European research project setting: the case of SOBIGDATA++"*. Alessandro, who was supervised by Nicola del Sarto and Alberto Di Minin of IdM, analyzed data on collaborations within the SoBigData++ project, in which the Sant'Anna School and EMbeDS have an important role (see Section 6) (<https://www.embeds.santannapisa.it/news/alessandro-marchesin-presents-dissertation-titled-%E2%80%9Cknowledge-sharing-and-network-dynamics%20%E2%80%9C>).

Importantly, in 2020 members of the EMbeDS community led an application by the Sant'Anna School to become part of **PhD-AI.it** (<https://www.phd-ai.it>), a novel nation-wide doctoral program sponsored by MUR and CNR. PhD-AI.it will be organized in five clusters of universities. The one coordinated by the University of Pisa, which will focus on the role of Artificial Intelligence and related techniques in the Social Sciences, will take the place of the current PhD in Data Science.

3. EDUCATION AND RESEARCH-RELATED ACTIVITIES: VISITORS

Plans for visitors in 2020 were disrupted by the COVID-19 pandemic. We were able to host a visit by **Marcelo C. Pereira**, (Associate Professor of Microeconomics and Quantitative Methods at the University of Campinas, Brazil) early in the year, who worked on micro-macro dynamics modeling and model validation with Giovanni Dosi, Andrea Roventini and others (Institute of Economics), and held lectures on the effective use of agent-based models in macroeconomic applications. We also had plans for visits by **Martin Kenney** (Distinguished Professor of Community and Regional Development at the University of California Davis), **Jani Anant** (a Research Fellow at Oxford University working on value-based Healthcare programs), **Alan Kirman** (Professor Emeritus of Economics at the Aix-Marseille University and at the Ecole des Hautes Etudes en Sciences Sociales, and member of the Institut Universitaire de France); **Amir Sani** (research associate with Rama Cont at the CFM-Imperial Institute of Quantitative Finance in the Department of Mathematics at Imperial College London, and external research fellow at the Institute of Economics of Sant'Anna); **Paul Battaglio** (Professor of Public and Nonprofit Management at the University of Dallas and Co-Editor-in-Chief of *Public Administration Review*); **Bin Yu** (Chancellor's Professor in the Departments of Statistics and of Electrical Engineering & Computer Sciences at UC Berkeley); **Peter Laussen** (Chief of the Department of Critical Care Medicine at the Hospital for Sick Children, Professor in Anaesthesiology and David and Stacey Cynamon Chair in Critical Care Medicine at the University of Toronto); **Klaus Keller** (Professor of Geosciences and Director of the Center for Climate Risk Management at Penn State); **Delmas Magali** (Professor of Management at the UCLA Institute of the Environment and Anderson School of Management); **Josè Scheinkman** (Professor of Economics at Columbia University); **Erik Stam** (Professor at the School of Economics of Utrecht University); **Marco Tedesco** (Lamont Research Professor at Columbia University) and **Guido Cervone** (Professor of Geography, Meteorology and Atmospheric Science at Penn State University), and others. All these plans had to be cancelled due to the pandemic, but we are hopeful that we will be able to reschedule a large portion of these visits in the near future.



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

4. EDUCATION AND RESEARCH-RELATED ACTIVITIES: WORKSHOPS AND MEETINGS RELATED TO EMbeDS

Also activities related to workshops and meetings were seriously hindered by the COVID-19 epidemic during 2020. EMbeDS members were able to attend and participate to the organization of some initiatives early in the year. Among them:

- In January 2020, a webinar on *the Orbis IP Database*.
<https://www.embeds.santannapisa.it/news/webinar-orbis-ip-database>
- In January 2020, a workshop titled *Il Fisco del Futuro: Nuove tecnologie, semplificazione tributaria e lotta all'evasione* with the participation of representatives from MEF and INPS.
<https://www.embeds.santannapisa.it/news/il-fisco-del-futuro-nuove-tecnologie-semplificazione-tributaria-e-lotta-all%E2%80%99evasione-workshop>
- In February 2020, a kick-off meeting for the SoBigData++ project funded by the European Commission (see Section 6).
<https://www.embeds.santannapisa.it/news/sobigdata-kick-meeting>

EMbeDS members also contributed to various initiatives held online or in blended mode later in the year. Among them:

- In May 2020, the Data Science Colloquium 2020 (among the speakers were Andrea Vandin, Francesco Lamperti and Denise Amram from the Sant'Anna School).
<https://www.embeds.santannapisa.it/news/data-science-colloquium-2020>
- In September 2020, the Annual Economics PhD Workshop.
<https://www.embeds.santannapisa.it/news/great-success-annual-phd-workshop-institute-economics>
- In October 2020, as part of the LEM seminar series of the Institute of Economics, talks focusing on the COVID-19 epidemic. Jacopo Di Iorio (a postdoctoral fellow funded by EMbeDS) presented *"The shapes of an epidemic: using Functional Data Analysis to characterize Covid-19 in Italy"*. Fabio Vanni (a researcher at the Observatoire Français des Conjonctures Economiques, Paris) presented *"The epidemic spread potential under physical distancing interventions"*.
<https://www.embeds.santannapisa.it/news/lem-seminar-series-restarts-two-talks-covid-19-spreading>
- In October 2020, the first of a series of workshops organized by the young researchers of CoMoS (Complexity Modelers' Society) to kickstart collaborations and applications of advanced simulation and data analysis techniques to *Climate Change* problems – with colleagues at IUSS (Pavia) and various US universities.
<https://www.embeds.santannapisa.it/news/comos-climate-change-meeting-october-2020>
- In November 2020, a series of webinars on *Predictive Justice* organized by the LIDER Lab and EMbeDS concerning regulation and ethics framework, potential applications of Data Science and AI to serve the justice sector, and an assessment of their risks and opportunities.
<https://www.embeds.santannapisa.it/news/lider-lab-and-embeds-organize-series-webinars-dedicated-predictive-justice>

- In December 2020, a conference by the GROWINPRO consortium (see Section 6) dedicated to the socio-economic consequences of the COVID-19 pandemic, presenting the latest research of consortium members, analyses and policy guidelines to tackle the COVID-19 crisis.
<https://www.embeds.santannapisa.it/news/growinpro-conference-dedicated-analsis-socio-economic-consequences-covid-19-pandemic-december>

5. EDUCATION AND RESEARCH-RELATED ACTIVITIES: SELECTED ARTICLES, MANUSCRIPT AND CONFERENCES

ARTICLES and MANUSCRIPTS

Faculty, researchers and students belonging to the EMbeDS community published a number of articles in peer-reviewed outlets in 2020. Neglecting bibliometrics (which is hardly indicative within a 1-year span), we report below a selection of those which we consider of high potential impact for the research areas covered by EMbeDS (first author alphabetical order):

- Baldassarini A., Di Vetta G., Morgante G., Pavone P., Romano M.F. (2020). "La misurazione della corruzione attraverso le sentenze della magistratura: una proposta metodologica con strumenti di text mining". *FEDERALISMI.IT*, 33, p. 164-187 (ISSN 1826-3534)
- Bellomo, N., G. Dosi, D. A. Knopoff, M. E. Virgillito. (2020). "From Particles to Firms: On the Kinetic Theory of Climbing Up Evolutionary Landscapes". *Mathematical Models and Methods in Applied Sciences*, 30(7), p. 1441-1460 (DOI: 10.1142/ S021820252050027X)
- Bellomo N., R. Bingham, M. A. J. Chaplain, Dosi, G., G. Forni, D. A. Knopoff, J. Lowengrub, R. Twarock, M. E. Virgillito (2020). "A Multi-Scale Model of Virus Pandemic: Heterogeneous Interactive Entities in a Globally Connected World". *Mathematical Models and Methods in Applied Sciences*, 30(8), p. 1591-1651 (DOI: 10.1142/ S0218202520500323)
- Brancaccio E., Califano A., Loprete M., Moneta A. (2020). "Nonperforming Loans and Competing Rules of Monetary Policy: a Statistical Identification Approach". *Structural Change and Economic Dynamics* (DOI: 10.1016/j.strueco.2020.02.001)
- Campi M., Duenas M., Fagiolo, G. (2020). "How do countries specialize in food production? A complex-network analysis of the global agricultural product space". *Environmental Research Letters*, 15(12) (DOI: 10.1088/1748-9326/abc2f6)
- Campi M., Duenas M., Fagiolo G. (2020). "Specialization in food production affects global food security and food systems sustainability". Forthcoming, *World Development* (DOI: 10.1016/j.worlddev.2021.105411)
- Cardelli L., Pérez-Verona I. C., Tribastone M., Tschaikowski M., Vandin A., Waizmann, T. (2020). "Exact maximal reduction of stochastic reaction networks by species lumping". *Bioinformatics* (DOI: 10.1093/bioinformatics/btab081)
- Cantarelli P., Belle N., Longo F. (2020). "Exploring the motivational bases of public mission-driven professions using a sequential-explanatory design". *Public Management Review* (DOI: 10.1080/14719037.2019.1642950)



- Cetrulo A., D. Guarascio, Virgillito M.E. (2020). "The privilege of working from home at the time of social distancing". *Intereconomics*, 55, p. 142-147 (DOI: 10.1007/s10272-020-0891-3)
- Comandé G. (2020). "Unfolding the Legal Component of Trustworthy AI: A Must to Avoid Ethics Washing". Forthcoming, *Annuario di Diritto Comparato e di Studi Legislativi* 45ss (DOI: 10.2139/ssrn.3690633)
- Coronese M., Lamperti F., Keller K., Chiaromonte F., Roventini A. (2020). "Reply to Geiger and Stomper: On capital intensity and observed increases in the economic damages of extreme natural disasters". *Proceedings of the National Academy of Sciences* (DOI: 10.1073/pnas.1922722117)
- Daddi T., Bleischwitz R., Todaro N.M., Gusmerotti N.M., De Giacomo M.R. (2020). "The influence of institutional pressures on climate mitigation and adaptation strategies". *Journal of Cleaner Production* (DOI: 10.1016/j.jclepro.2019.118879)
- De Giacomo M.R., Bleischwitz R. (2020). "Business models for environmental sustainability: Contemporary shortcomings and some perspectives". *Business Strategy and the Environment* (DOI: 10.1002/bse.2576)
- De Pleijt, A., Nuvolari A., Weisdorf J. (2020). "Human Capital Formation during the First Industrial Revolution: Evidence from the Use of Steam Engines". *Journal of the European Economic Association*, vol. 18, p. 829-889 (DOI: 10.1093/jeea/jvz006)
- De Rosis S., Guidotti E., Zuccarino S., Venturi G., Ferré, F. (2020). "Waiting time information in the Italian NHS: A citizen perspective". *Health Policy* (DOI: 10.1016/j.healthpol.2020.05.012)
- Di Iorio J., Chiaromonte F., Cremona M.A. (2020). "On the bias of H-scores for comparing biclusters, and how to correct it". *Bioinformatics*, 36(9), p.2955–2957 (DOI: 10.1093/bioinformatics/btaa060)
- Domini G., Grazzi M., Moschella D., Treibich T. (2020). "Threats and opportunities in the digital era: Automation spikes and employment dynamics". *Research Policy* (DOI: 10.1016/j.respol.2020.104137)
- Dosi G., Roventini A., Russo E. (2020). "Public policies and the art of catching up: matching the historical evidence with a multicountry agent-based model". *Industrial and Corporate Change* (DOI: 10.1093/icc/dtaa057)
- Dosi G., Napoletano M., Roventini A., Stiglitz J., Treibich, T. (2020). "Rational Heuristics? Expectations and Behaviors in Evolving. Economies with Heterogeneous Interacting Agents". *Economic Inquiry* (DOI: 10.3386/w26922)
- Dosi G., Grazzi M., Moschella D., Pisano G., Tamagni F. (2020). "Long-term firm growth: an empirical analysis of US manufacturers 1959-2015". *Industrial and Corporate Change*, 29(2), p. 309-332 (DOI: 10.1093/icc/dtz044)
- Dosi G., Fanti L., Virgillito M.E. (2020). "Unequal societies in usual times, unjust societies in pandemic ones". *Journal of Industrial and Business Economics*, 47, p.371-389 (DOI: 10.1007/s40812-020-00173-8)
- Fagiolo G., Giachini D., Roventini, A. (2020). "Innovation, finance, and economic growth: an agent-based approach". *Journal of Economic Interaction and Coordination*, 15, p. 703–736 (DOI: 10.1007/s11403-019-00258-1)
- Fontana M., Iori M., Montobbio F., Sinatra R. (2020). "New and atypical combinations: An assessment of novelty and interdisciplinarity". *Research Policy* (DOI: 10.1016/j.respol.2020.104063)



- Guerini M., Moneta A., Napoletano M., Roventini A. (2020). "The Janus-Faced Nature of Debt: Results from a Data-Driven Cointegrated SVAR Approach". *Macroeconomic Dynamics* (DOI: 10.1017/S136510051800044)
- Horenberg F., Lungu D.A., Nuti S. (2020). "Measuring research in the big data era: The evolution of performance measurement systems in the Italian teaching hospitals". *Health Policy* (DOI: 10.1016/j.healthpol.2020.10.002)
- Kenney A., Chiaromonte F., Felici G. (2020). "MIP-BOOST: Efficient and Effective L₀ Feature Selection for Linear Regression". *Journal of Computational and Graphical Statistics* (DOI: 10.1080/10618600.2020.1845184)
- Lamperti F., Dosi G., Napoletano M., Roventini A., Sapio A. (2020). "Climate change and green transitions in an agent-based integrated assessment model". *Technological Forecasting and Social Change* (DOI: 10.1016/j.techfore.2019.119806)
- Lahr H., Mina A. (2020). "Endogenous financial constraints and innovation". *Industrial and Corporate Change* (DOI: 10.1093/icc/dtaa035)
- Lenzi J., Noto G., Corazza I., Lepiksone J., Fantini M. P. (2020). "Measuring the quality of care in small countries: the empirical analysis of 30-day mortality following acute myocardial infarction and ischaemic stroke in Latvia". *Health Policy* (DOI: 10.1016/j.healthpol.2020.05.017)
- Magazzini L., Bruno R.L., Stampini M. (2020). "Using information from singletons in fixed-effects estimation: xtfsing". *The Stata Journal*, 20 (4), p. 965-975 (DOI: 10.1177/1536867X20976326)
- Martinelli A., Mina A., Moggi M. (2020). "The enabling technologies of Industry 4.0: Examining the seeds of the Fourth Industrial Revolution". Forthcoming. *Industrial and Corporate Change* (DOI: 10.2139/ssrn.3726922)
- Marullo C., Martelli I., Di Minin A. (2020). "The many shades of 'openness': an application of item response theory to open innovation research". *R&D Management* (DOI: 10.1111/radm.12440)
- Marullo C., Di Minin A., Martelli I., Piccaluga, A. (2020). "Solving the 'heterogeneity puzzle': a comparative look at SMEs growth determinants in open and closed innovation patterns". *Int. J. Entrepreneurship and Innovation Management* (DOI: 10.1504/IJEIM.2020.110099)
- Mina A., Di Minin A., Martelli I., Testa G., Santoleri P. (2020). "Public funding of innovation: Exploring applications and allocations of the European SME Instrument". *Research Policy* (DOI: 10.1016/j.respol.2020.104131)
- Mina A., Santoleri P. (2020). "The effect of the Great Recession on the employment growth of young vs. small firms in the Eurozone". *Structural Change and Economic Dynamics*, 56, p. 184-194 (DOI: 10.1016/j.strueco.2020.11.002)
- Miroshnychenko I., De Massis A., Miller D. e Barontini R. (2020). "Family business growth around the world". *Entrepreneurship Theory and Practice* (DOI: 10.1177/1042258720913028)
- Nandy D., Chiaromonte F., Li R. (2020). "Covariate Information Number for Feature Screening in Ultrahigh-Dimensional Supervised Problems". *Journal of the American Statistical Association* (DOI: 10.1080/01621459.2020.1864380)
- Noto G., Belardi P., Vainieri M. (2020). "Unintended consequences of expenditure targets on resource allocation in health systems". *Health Policy* (DOI: 10.1016/j.healthpol.2020.01.012)



- Nuti S., Ferré F., Seghieri C., Foresi E., Stukel TA. (2020). "Managing the performance of general practitioners and specialist referral networks: A system for evaluating the heart failure pathway". *Health Policy* (DOI: 10.1016/j.healthpol.2019.11.001)
- Pirri S., Lorenzoni V., Turchetti G. (2020). "Scoping review and bibliometric analysis of Big Data applications for Medication adherence: an explorative methodological study to enhance consistency in literature". *BMC Health Serv Res*, 20, 688 (DOI: 10.1186/s12913-020-05544-4)
- Popoyan L., Napoletano M., Roventini A. (2020). "Winter is Possibly not Coming: Mitigating Financial Instability in an Agent-Based Model with Interbank Market". *Journal of Economic Dynamics & Control* (DOI: 10.1016/j.jedc.2020.103937)
- Porumbescu G.A., Cucciniello M., Belle N. and Nasi, G. (2020). "Only hearing what they want to hear: Assessing when and why performance information triggers intentions to coproduce". *Public Administration* (DOI:10.1111/padm.12697)
- Rizzi F., Annunziata E., Contini M., Frey M. (2020). "On the effect of exposure to information and self-benefit appeals on consumer's intention to perform pro-environmental behaviours: A focus on energy conservation behaviours". *Journal of Cleaner Production*, 270, 122039 (DOI: 10.1016/j.jclepro.2020.122039)
- Rocchetta S., Mina A., Lee C., Kogler D. (2020). "Technological knowledge spaces and the resilience of European regions". Forthcoming, *Journal of Economic Geography* (DOI: 10.1093/jeg/lbab001)
- Romano M.F., Baldassarini A., Pavone P. (2020). "Text Mining of Public Administration documents: preliminary results on judgements". *Text Analytics: Advances and Challenges* (Studies in Classification, Data Analysis, and Knowledge Organization). Lezzi D.F., Mayaffre D., Misuraca M. (eds). Springer 1st ed. 2020, p. 117-126 (ISBN: 9783030526795)
- Romano M.F. (2020). "Methodological innovations to estimate illegal economy". Dall'incertezza alla decisione consapevole: un percorso da fare insieme. *Atti della 13a Conferenza Nazionale di Statistica*, p. 142-148 (ISBN 9788845820168).
- Seri R., Martinoli M., Secchi, D., Centorrino S. (2020). "Model Calibration and Validation via Confidence Sets". Forthcoming, *Econometrics and Statistics* (DOI: 10.1016/j.ecosta.2020.01.001)
- Scarrà D., Piccaluga A. (2020). "The impact of technology transfer and knowledge spillover from Big Science: a literature review". *Technovation*, 102165 (DOI: 10.1016/j.technovation.2020.102165)
- Sganga C. (2020). "A new era for EU copyright exceptions and limitations?" *ERA Forum* 21, 311-339 (DOI: 10.1007/s12027-020-00623-9)
- Ter Beek M. H., Legay A., Lluch-Lafuente A., Vandin A. (2020). "A Framework for Quantitative Modeling and Analysis of Highly (Re)configurable Systems". *IEEE Transaction in Software Engineering* (DOI: 10.1109/TSE.2018.2853726)
- Tripodi G., Chiaromonte F., Lillo F. (2020). "Knowledge and social relatedness shape research portfolio diversification". *Scientific Reports*, 10, 14232 (DOI:10.1038/s41598-020-71009-7)
- Vainieri M., Paneri C., Coletta L. (2020). "Waiting times in emergency departments: a resource allocation or an efficiency issue?" *BMC Health Services Research* (DOI:10.1186/s12913-020-05417-w)
- Vizzoto F., Tessitore S., Iraldo F., Testa F. (2020). "Passively concerned: Horeca managers' recognition of the importance of food waste hardly leads to the adoption of more strategies to reduce it". *Waste Management*, 107, p. 266-275 (DOI: 10.1016/j.wasman.2020.04.010)



- Vola F., Vinci B., Golinelli D., Fantini M.P., Vainieri M. (2020). "Harnessing pharmaceutical innovation for anti-cancer drugs: Some findings from the Italian regions". *Health Policy* (DOI: 10.1016/j.healthpol.2020.07.016)
- Wiegersma S., Flinterman L.E., Seghieri C., et al. (2020). "Fitness for purpose of routinely recorded health data to identify patients with complex diseases: The case of Sjogren's syndrome". *Learning Health Systems* (DOI: <https://doi.org/10.1002/lrh2.10242>)

We also report below selected manuscripts that are currently undergoing peer review and are available as preprints through online platforms (first author alphabetical order):

- Boschi T., Di Iorio J., Testa L., Cremona M.A., Chiaromonte F. (2020). "The shapes of and epidemic: using Functional Data Analysis to characterize COVID-19 in Italy".
Preprint available at <https://arxiv.org/pdf/2008.04700.pdf>
- Cintia P., et al. (2020). "The relationship between human mobility and viral transmissibility during the COVID-19 epidemics in Italy".
Preprint available at <https://arxiv.org/pdf/2006.03141.pdf>
- Fagiolo G. (2020). "Assessing the Impact of Social Network Structure on the Diffusion of Coronavirus Disease (COVID-19): A Generalized Spatial SEIRD Model".
Preprint available at <https://arxiv.org/abs/2010.11212>
- Insolia L., Kenney A., Chiaromonte F., Felici G. (2020). "Simultaneous Feature Selection and Outlier Detection with Optimality Guarantees".
Preprint available at <https://arxiv.org/pdf/2007.06114.pdf>
- Pichler A., Pangallo M., Del Rio-Chanona R.M., Lafond F., Farmer J.D. (2020). "Production networks and epidemic spreading: How to restart the UK economy".
Preprint available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3606984
- Seri R., Secchi, D., Martinoli, M. (2020). "Randomness, emergence and causation: A historical perspective on simulation in the social sciences".
Preprint available at <https://rseri.me/publication/b019/>
- Tognazzi S., Tribastone M., Tschaikowski M., Vandin A. (2020). "Differential Equivalence for Linear Differential Algebraic Equations".
Preprint available at <http://bit.ly/DiffEqLDAEs>
- Vandin A., Giachini D., Lamperti F., Chiaromonte F. (2020). "Automated and Distributed Statistical Analysis of Economic Agent-Based Models".
Preprint available at <https://arxiv.org/pdf/2102.05405.pdf>
- Vizzoto F., Testa F., Iraldo, F. (2021). "Strategies to reduce food waste in the foodservices sector: a systematic review. International Journal of Hospitality Management".
Preprint available at https://www.researchgate.net/publication/350682634_Strategies_to_reduce_food_waste_in_the_foodservices_sector_A_systematic_review
- Waizmann T., Bortolussi L., Vandin A., Tribastone M. (2020). "Improved estimations of stochastic chemical kinetics by finite state expansion".
Preprint available at <https://arxiv.org/pdf/2006.06987.pdf>



Department
of Excellence
2018 - 2022

EMbeDS

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TALKS AT CONFERENCES AND WORKSHOPS

Notwithstanding many conference and academic travel cancellations due to the pandemic, faculty, researchers and students belonging to the EMbeDS community presented their work at a number of important national and international Conferences and Workshops held online in 2020. Among those are (presenter in bold):

- **Annunziata E.**, Rizzi F., Frey M. "The interplay of business models with sustainable innovations: evidence from Italian SMEs in the energy sector". SIMA Conference 2020. 7-8 September 2020 (online).
- **Barontini R.**, Guidi G. "ESG news and stock market returns of S&P500 Shares". Convegno annuale ADEIMF. September 2020 (online).
- **Barontini R.**, Miroshnychenko I., Testa F. "Family firms and environmental performance: A meta-analytic review". IFERA Conference. 20-22 June 2020 (online).
- **Coronese M.**, Ocellì M., Lamperti F., Roventini A. "Is green the new black? An ABM approach on transitions towards sustainable agriculture". The 32nd EAEPE Annual European Association for Evolutionary Political Economy Conference. September 2020 (online).
- Costa S., De Santis S., Dosi G., Monducci R., Sbardella A., **Virgillito M. E.** "Alle radici della stagnazione: Una tassonomia della struttura produttiva italiana". Webinar at Economia Italiana-ISTAT. NetSci - International School and Conference on Network Science. November 2020 (online). https://www.istat.it/it/files//2020/11/Programma_25novembre2020.pdf
- **Da Ros A.**, Vainieri M., "Physiotherapists' job satisfaction: empirical evidence from Tuscany region". EHMA 2020 Annual Conference. 17-19 November 2020 (online). <https://ehmaconference.org/ehma-2020-abstract-book>
- **Dang H.**, Cremona M.A., Chiaromonte F. "Characterizing smooth trends and irregular spikes in longitudinal data". ERCIM 2020 -- 13th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2020). December 2020 (online). <http://www.cmstatistics.org/RegistrationsV2/CMStatistics2020/viewSubmission.php?in=767&token=nnosor88o5pr523n2714q323on5918n6>
- De Rassenfosse G., Grazi M., **Moschella D.**, Pellegrino G. "International Patent Protection and Trade: Transaction-Level Evidence". Invited Webinar, joint UNU-MERIT and MGSoG seminars series. June 2020 (online). <http://www.lem.sssup.it/WPLem/files/2020-07.pdf>
- De Rassenfosse G., Grazi M., **Moschella D.**, Pellegrino G. "International Patent Protection and Trade: Transaction-Level Evidence". ESCoE Conference on Economic Measurement 2020 (EM2020). 16-18 September 2020 (online). <http://www.lem.sssup.it/WPLem/files/2020-07.pdf>
- **De Rosis S.**, **Bonci M.**, Nuti S. "Patient experience with health care services in times of pandemic: evidence from Italy". Workshop & Special Issue: Covid-19 and Marketing Research in Italy. October 2020 (online).
- De Rosis S., **Pennucci F.**, Lungu D. A., Nuti S., "Patient-Reported Outcome Measures to Prioritize Surgical Lists during Pandemic Events". ISPOR Europe 2020. 16-19 November (online). <https://doi.org/10.1016/j.jval.2020.08.1734>
- Cucino V., Del Sarto N., Ferrigno G., Paraboschi A., **Piccaluga A.** "Innovating in the fourth industrial revolution: disentangling trends and trajectories". SIMA Conference 2020. 7-8 September (online). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3637867



- Domini G., Grazzi M., **Moschella D.**, Treibich T. "Threats and opportunities in the digital era: Automation spikes and employment dynamics". Research Policy Paper Development Workshop. January 2020, Manchester.
<https://www.sciencedirect.com/science/article/abs/pii/S0048733320302122>
- **Insolia L.**, Kenney A., Chiaromonte F., Felici G. "Simultaneous Feature Selection and Outlier Detection with Optimality Guarantees". ERCIM 2020 -- 13th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2020). December 2020 (online).
<http://www.cmstatistics.org/RegistrationsV2/CMStatistics2020/viewSubmission.php?in=807&token=449650porrpopn7n85o498506o067405>
- **Insolia L.**, **Kenney A.**, Chiaromonte F., Felici G. "Simultaneous Feature Selection and Outlier Detection with Optimality Guarantees". Joint Statistical Meetings. August 2020 (online).
<https://www2.amstat.org/meetings/jsm/2020/onlineprogram/AbstractDetails.cfm?abstractid=313642>
- Iraldo F., Tessitore S., Testa F., **Vizzoto F.** "The adoption of food waste reduction strategies in the foodservices sector: Evaluating the roles of importance recognition and measurement". 20th Annual Conference of the European Academy of Management (Euram). 4-6 December 2020 (online).
- **Martinelli A.**, **Mina A.**, Romito E. "Collective licensing: The double effect of the Medicine Patent Pool on access to drugs in developing countries". 13th Annual Northwestern/USPTO Conference on Innovation Economics. January 2020 (online).
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjWlNn9yLfuAhUj2-AKHZFFBtgQFjADegQIBBAC&url=https%3A%2F%2Fwww.law.northwestern.edu%2Fresearch-faculty%2Fclbe%2Fevents%2Finnovation%2Fdocuments%2Fmina_martinelli.pdf&usg=AOvVaw09DrvP-sSk8djC0dm-whGI
- **Martinoli M.**, Seri R. "Nonparametric moment-based estimation of simulated models without optimization". 14th International Conference on Computational and Financial Econometrics (CFE 2020). 19-21 December 2020 (online).
- **Martinoli M.**, Seri R. "Nonparametric Moment-based Estimation of Simulated Models via Regularized Regression". SSW2020 - Workshop on the Boundaries of Agent-based Modelling in Social Simulation Week 2020 organized by ESSA (European Social Simulation Association). September 2020 (online).
- **Martinoli M.**, Seri R., Secchi D., Centorrino S., Vezzulli A. "Counterfactual Evaluation in history-friendly models limits and perspectives". 1st Meeting of the Network on Counterfactual Impact Evaluation (NetCIEx). Joint Research Center. January 2020 (online).
- **Mina A.**, Di Minin A., Martelli I., Testa G., Santoleri P. "Public funding of innovation: exploring applications and allocations of the European SME Instrument". *JRC Brussels Workshop on Entrepreneurial ecosystems for high growth enterprises. February 2020, Brussels. Based on the paper at <https://doi.org/10.1016/j.respol.2020.104131>
- **Moschella D.** "International Patent Protection and Trade: Transaction-Level Evidence". 61th Annual Conference of the Italian Economic Association. 20-23 October 2020 (online). Based on the paper at <http://www.lem.sssup.it/WPLem/files/2020-07.pdf>
- **Murante A.M.**, **Gennuso G.**, "Building autonomy for maintaining active healthy ageing behaviours in the adult population". International Marketing Trends. 16-18 January 2020, Parigi.
<http://archives.marketing-trends-congress.com/2020/pages/PDF/013.pdf>
- **Pangallo M.** "Synchronization of endogenous business cycles". NETSci - Network Science Society Conference 2020. 17-25 September (online). Based on the paper at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3538999



- **Rocchetta S.**, Mina A., Lee C., Kogler D. "Technological knowledge spaces and the resilience of European regions". 5th Geography of Innovation Conference 2020. 29-31 January 2020, Stavanger.
- **Romano M.F.**, Comandè G., Amram D., Pavone P. "The challenges of legal analysis, between text mining and machine learning". Session on 'Big brother, big data or both? Protecting privacy in the era of big data'. BigSurv20 - Big Data Meets Survey Science. November 2020 (online). <https://www.bigsurv20.org/conf20/program/?sess=24#224>
- **Romano M.F.**, Comandè G., Amram D., Pavone P., "The challenges of legal analysis, between text mining and machine learning". JADT 2020: 15 Journées Internationales d'Analyse statistique des Données Textuelles. 16-19 June 2020 (online)
- **Santoleri P.**, Mina A., Di Minin A., Martelli I. "The causal effects of R&D grants: evidence for a regression discontinuity". European Economic Association Congress. 24-28 August 2020 (online). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3637867
- **Santoleri P.**, **Mina A.**, Di Minin A., Martelli I., "The causal effects of R&D grants: evidence for a regression discontinuity". NBER Summer Institute (Innovation and Productivity), National Bureau of Economic Research. 14-15 July 2020 (online).
- **Seri R.**, **Martinoli M.**, Centorrino S. Secchi D. "Calibration of agent- based simulation models via Model Confidence Sets". Webinar on the Boundaries of ABM. January 2020 (online).
- **Tripodi G.** Chiaromonte F., Lillo F., "Knowledge and social relatedness shape research portfolio diversification". NetSci - International School and Conference on Network Science. 17-25 September (online). Based on the paper at <https://doi.org/10.1038/s41598-020-71009-7>
- **Tripodi G.** Chiaromonte F., Lillo F., "Knowledge and social relatedness shape research portfolio diversification". IC2S2 - 6th International Conference on Computational Social Science. 17-20 July (online). Based on the paper at <https://doi.org/10.1038/s41598-020-71009-7>

6. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: INTERNAL AND EXTERNALLY FUNDED PROJECTS

Several research projects by the EMbeDS community have taken shape during 2020, supported by the High Performance Computing Infrastructure established in 2019 and 2020 (see Section 10). The table below provides a snapshot of some such project, organized by the VMs (Virtual Machines) created on our cluster:

VM	Description
IdE (Economics)	Various projects by IdE researchers, among which: analyses of massive patent datasets, Agent Based Model simulations and development of related statistical methods, causal statistics techniques, robust statistics techniques, optimization.
IdM (Management)	Various projects by IdM researchers, among which: analysis of patents related to small and medium-sized firms, text mining, analyses of twitter data related to COVID-19.
Predictive Justice	Various projects within the Predictive Justice umbrella (predictivejustice.eu), including preprocessing of text data from verdicts, their pseudo-anonymization, and their analysis with AI algorithms.
CoMoS Climate Change	Various projects related to climate change and its socio-economic impacts by the young researchers in CoMoS, including large simulations and storage and analyses of massive geo-localized data sets on climate features and economic indicators.



CoMoS Technology and Innovation	Science, and	Various projects related to science, technology and innovation by the young researchers in CoMoS, including network-based and statistical analyses of massive bibliometric datasets on scientific publications, patent datasets, etc.
CoMoS Dynamics	Economic	Various projects related to economic dynamics by the young researchers in CoMoS, among which: Agent Based Models of macroeconomic phenomena, models of financial markets, models of industrial dynamics, and machine learning approaches for the representation of decision making.
DBMS		SQL Database Management System to support various EMbeDS projects
ISV (Life Sciences)		Various projects by ISV researchers, among which analysis of large genomic data on crops and plants under-characterized to date, development of bioinformatics methods.
TALTAC		TalTac project (taltac.com); development and testing of the version 4.0 of the TalTac textmining software
MeS		Various project by researchers of the MeS Laboratory of IdM, among which CoNtAcT (Chronic Network Accountability, Tuscany), studies of the Healthcare system and of patients experience and satisfaction, analysis of large datasets from administrative sources and <i>ad hoc</i> surveys.

Faculty, researchers and students belonging to the EMbeDS community also continued their work on a variety of externally funded projects. We report below a selection of those which we consider of high potential impact for the research areas covered by EMbeDS.

Among the projects awarded or beginning in 2020:

- DigiCare4You H2020 (European Commission). 2021-2025. Unit leader at SSSA: C. Seghieri. DigiCare4You project aims to develop, implement and evaluate organizational, technological and public health innovation aiming to empower families and integrate community care services in Europe for the prevention and management of type 2 diabetes and/or hypertension.
- LEAP-RE H2020 (European Commission). 2020-2025. Unit leaders at SSSA: M.Frey, E. Annunziata. The project aims at supporting long-term, bi-regional cooperation in research, innovation, and capacity building in renewable energies, particularly by analyzing socio-economic aspects for the implementation of geothermal energy (thermal uses and power production) investments and plants in Africa.
- CORALIS H2020 (European Commission). 2020-2024. Unit leader at SSSA: M.Frey, E. Annunziata. The project aims at developing and supporting new value chain relations and business models for long-term industrial symbiosis
- SoBigData++ H2020 (European Commission). 2020-2024. Unit leaders at SSSA: A. Piccaluga. SoBigData++ strives to deliver a distributed, Pan-European, multi-disciplinary research infrastructure for big social data analytics, coupled with the consolidation of a cross-disciplinary European research community, aimed at using social mining and big data to understand the complexity of our contemporary, globally interconnected society. SoBigData++ is set to advance on such ambitious tasks thanks to SoBigData, the predecessor project that started this construction in 2015. Becoming an advanced community, SoBigData++ will strengthen its tools and services to empower researchers and innovators through a platform for the design and execution of large-scale social mining experiments. It will be open to users with diverse background, accessible on a project cloud (aligned with EOSC) and also exploiting



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

supercomputing facilities. Pushing the FAIR principles further, SoBigData++ will render social mining experiments more easily designed, adjusted and repeatable by domain experts that are not data scientists. <https://cordis.europa.eu/project/id/871042/it>

- RECREATING EUROPE H2020 (European commission) 2020-2022. PI and consortium coordinator: C. Sganga (DIRPOLIS, SSSA). Unit leaders at SSSA: A. Martinelli, A. Nuvolari. ReCreating Europe aims at bringing a ground-breaking contribution to the understanding and management of copyright in the DSM, and at advancing the discussion on how IPRs can be best regulated to facilitate access to, consumption of and generation of cultural and creative products. The focus of such an exercise is on, inter alia, users' access to culture, barriers to accessibility, lending practices, content filtering performed by intermediaries, old and new business models in creative industries of different sizes, sectors and locations, experiences, perceptions and income developments of creators and performers, who are the beating heart of the EU cultural and copyright industries, and the emerging role of artificial intelligence (AI) in the creative process. <https://www.recreating.eu/>
- LeADS Legality Attentive Data Scientists H2020 (European Commission) 2021-2024. PI and consortium coordinator: G. Comand  (DIRPOLIS, SSSA). LeADS aim is to train a new interdisciplinary professional figure with expertise in both in data science and law, bridging scientific skills with the ethico-legal constraints of their operating environment. Fostering integrated research and educational activities, the program will develop a data science capable of maintaining its innovative solutions within the boundaries of law - by design and by default - and of expanding such boundaries in line with innovation needs, generating a comparative interdisciplinary lexicon and critical crossover concepts. LeADS offers an innovative curriculum linked to pioneering research results, with the goal of changing the regulatory and business approach to information, while producing experts able to take charge of the processes that every data driven society needs to employ.
- PRIN 2017 (Ministry of University and Research, Italy). 2020-2023. Lost highways: skills, technology and trade in Italian economic growth 1815-2018. Unit leader at SSSA: A. Nuvolari. This project examines the long-term historical roots of the recent Italian "falling behind". Our guiding hypothesis is that factor endowments, by encumbering investments in innovation and human capital formation, represented a major burden for the long-term development of the Italian economy. The project is structured around six main hypotheses on the relationships between factor endowment, real wages, skill premium, productivity growth, innovative activity, technological content of trade and economic performance. The project is fundamentally data-driven and it involves a major systematization of Italian economic series for the period from the end of the Napoleonic Wars to the present day. We will interpret the data using the standard analytical tools of new economic history and we will also explore some counterfactual scenarios using agent-based models, focusing on major historical junctures and key policy decisions.
- PRIN 2017 (Ministry of University and Research, Italy). 2020-2023. Technological change, industry evolution and employment dynamics. Unit leader at SSSA: D. Moschella. The project develops an integrated analysis of the anatomy and dynamics of innovation processes and the ensuing patterns of industrial change and employment, starting from the ways in which new knowledge is incorporated into business, down to the market processes of "Schumpeterian" competition. The project contains three main lines of research. First, we will investigate the micro-properties of industrial dynamics, looking at the way in which learning, selection, and firm growth shape industry evolution. Second, we will investigate the effects of trade and technology on job creation, job destruction, and wage dynamics at



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

the industry and firm level. Third, we will investigate the main features and the evolution of innovation patterns as well as the industrial dynamics in sectors that are characterized by the emergence of radical innovations within complex product-systems and general-purpose technologies. The contributions will be both empirical, by using firm-level and industry level data from several European countries, and theoretical, by developing agent-based modelling techniques.

- PRIN 2017 (Ministry of University and Research, Italy). 2020-2023. How good is your model? Empirical evaluation and validation of quantitative models in economics. PI and Unit leader at SSSA: A. Moneta. Contemporary economics makes increasingly use of quantitative models. For example, in macroeconomics, dynamic stochastic general equilibrium models or agent-based models are two kinds of models, that, moving from very different approaches, rely on simulation to assign values to key structural parameters. More in general, economic models are a sort of surrogate of experimental laboratories to evaluate causal claims and generate artificial data that are confronted with observed data. A major challenge for the empirical economist is the validation or evaluation problem, namely to find out "how good" or reliable is the model at hand, especially in comparison with alternative models. This is important both for improving the model and for understanding whether it is a reliable instrument for policy analysis. This project aims to develop new methods and techniques for the empirical validation of quantitative models in economics. The main idea underlying our framework is that a valid model adequately represents existing causal relationships. Therefore our framework, building on established methods for causal search, evaluates models by comparing the causal structure inferred from the model-generated artificial data with the causal structure inferred from a set of observed data.
- CoNtAcT - Chronic Network Accountability Tuscany (Accountable networks for chronic populations: new governance mechanisms to promote professional integration and value improvement) 2020-2023. Bando Ricerca Salute 2018 Regione Toscana. PI: C. Seghieri, CO-PI S. Nuti. The general aim of the project is to develop and validate alternative governance mechanisms to organize, evaluate and allocate resources for the care of chronic patients. This is intended to promote the integration and sharing of responsibilities among professionals (e.g., primary care and specialists) and increase value for patients and the system
- A Theory of Prediction for Economic Agent-Based Models (James S. Mc Donnell Foundation) 2020-2022. Unit leader at SSSA: M. Pangallo. The project aims at developing a theory for when Agent-Based Models (ABMs) outperform other classes of models in out-of-sample forecasting, and apply such a theory to economic ABMs. The forecasting power of ABMs is likely dependent on the granularity of the data that can be used for calibration and on the possibility to dynamically assimilate empirical time series data. If it was possible to show that ABMs beat traditional models in forecasting, their use would become more widespread. <https://www.jsmf.org/grants/2019000>

Among the ongoing projects:

- GROWINPRO H2020 (European commission). 2019-2022. PI and consortium coordinator: A. Roventini (IdE, SSSA). GROWINPRO builds upon the prior ISIGrowth project, deepening the 'diagnostic exercise' and extending the scope of investigation – fully addressing the interactions among innovation, productivity and growth in a world possibly undergoing a IV Industrial Revolution, wherein globalization exacerbated the diverging patterns of value distribution among countries and social groups. The project will thoroughly study the effects of monetary, fiscal and mission-oriented policies in stimulating



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

productivity and output growth. The team comprises leading international scholars and links to a group of National Statistical Offices developing new data and measurements. Policy recommendations will be grounded in solid micro-, meso- and macro analyses, always accounting for the feedbacks between Schumpeterian (supply side) and Keynesian (demand side) dynamics. Relevance and adequacy of the proposed policies will be continuously challenged through interactions with stakeholders belonging to European Institutions, civil society and business <http://www.growinpro.eu/>

- S-PARCS H2020 (European Commission). 2018-2021. Unit leaders at SSSA: M. Frey, E. Annunziata. The project aims at analyzing technical, economic, regulatory, legal, organizational, environmental and social barriers to energy- efficient park design and operation on all levels and will provide innovative, market-ready solutions to overcome them.
- Performance evaluation and value assessment for cardiovascular and oncological care paths in a regional network context: challenges and opportunities (Ricerca Finalizzata 2016 Ministero della Salute). 2019-2022. Unit leaders at SSSA: Scienze della Vita, V. Lionetti; Management, S. Nuti. Nowadays there is an increasing need to address the fragmentation of care by involving all healthcare stakeholders in charge of planning, provision and assessment of services to adopt population-based approach as the principle of service delivery through integrated care programs. The lack of continuity of care negatively affect the population leading to worse quality of life, greater healthcare utilization, higher age-adjusted mortality and longer length of hospital stay. This is particularly true for frail older people, people living with multi-morbidity, those living with long-term chronic and with complex needs. Within this context, developing and implementing effective performance measurement and evaluation systems is crucial to assess whether integrated care paths, including the diagnostic phase, improve patient's experiences and outcomes at cost-effective levels and respond appropriately to the different patient/caregiver needs. Measuring, feedback reporting and systematically benchmark value creation in multi-professional environment at both local, regional and national level is of priority and it is expected to generate positive learning effects, to promote health and performance improvements and to allow the diffusion of innovation.
- LIFE MAGIS (Project LIFE + Community Program). 2019-2022. Unit leaders at SSSA: F. Iraldo, F. Testa. The project aims to contribute to the dissemination of the voluntary national scheme for the assessment and communication of the environmental footprint of Made Green in Italy (MGI) products. SSSA will be committed to investigating which are the current dynamics that influence purchasing intentions towards green products, the level of trust towards labels and difficulties in understanding claims: crucial aspects to explore in order to plan actions of communication capable of supporting the diffusion between PEF and Made Green in Italy companies, and increasing the level of consumer satisfaction, as well as identifying a reference baseline for comparing over time the growth of consumer awareness and the reduction of perceived barriers.
- Support to the development of patient reported experience measures for health system performance assessment in Latvia (grant agreement n°srss/s2019/035). 2019-2021. Unit leaders at SSSA: S. Nuti, M. Vainieri. The general objective of this action is to contribute to institutional, administrative and growth-sustaining structural reforms in Latvia, in line with Article 4 of the Structural Reform Support Program (SRSP) Regulation. The specific objective of this action is to support the efforts of national authorities to define and implement appropriate processes and methodologies by taking into account good practices of and lessons learned by other countries in addressing similar situations, in line with Article 5 of the SRSP



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

Regulation. The achievement of those objectives is not solely the responsibility of the technical support provider and will depend partly but not only on the action of the Latvia Ministry of Health and other relevant Latvian authorities.

- Integrated care management, peer education and activation: strategies for effective promotion of protective behaviors among women with gestational diabetes at risk of developing type 2 diabetes (Italian Ministry of Health - CCM Program). 2019-2021. Unit leader at SSSA: A.M. Murante. The project aims to develop and strengthen personal skills necessary for the adoption of healthy behaviors, protective with respect to the risk of developing type 2 diabetes. It is addressed to women who receive a diagnosis of gestational diabetes during pregnancy. SSSA has the tasks of 1) training peer coaches who support women in this path, following the traces of a structured program based on a motivational interview; 2) develop an App as an informative and functional support for setting goals and monitoring behaviors. <http://www.ccm-network.it/progetto.jsp?id=node/2012&idP=740>

Among the projects concluded in 2020:

- LIFE EFFIGE (Project LIFE + Community Program) 2017-2020. Unit leaders at SSSA: F. Iraldo, F. Testa. The project is aimed at spreading and supporting the adoption of life cycle principles at Italian and European level, by experimenting with an innovative method for calculating the environmental performance of products and improving their environmental performance. The project is mainly aimed at small and medium-sized enterprises but also involves large organizations that can stimulate the adoption of PEF on a large scale. <https://www.lifeeffige.eu/>
- Gemex H2020 (European Commission) 2016-2020. Unit leaders at SSSA: M. Frey, E. Annunziata. The project aims at supporting the development of deep geothermal energy in Mexico by investigating geothermal potential and socio-economic aspects in terms of public engagement activities.

7. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: AFFILIATIONS

After affiliating **Giovanni Comand **, a faculty of the DIRPOLIS Institute and the coordinator of the LIDER-lab and of the Predictive Justice project, in September 2019 ([https://www.embeds.santannapisa.it/news/we-welcome-prof-giovanni-comand C3%A9-affiliate-department-excellence](https://www.embeds.santannapisa.it/news/we-welcome-prof-giovanni-comand%C3%A9-affiliate-department-excellence)) we continued with a policy of broadening the EMbeDS community through internal and external formal affiliations.

Within Sant'Anna, we affiliated **Roberto Buizza**, a faculty of the Life Sciences Institute and the leader of the 3CSA Center for Climate Studies, in March 2020 (<https://www.embeds.santannapisa.it/news/we-welcome-prof-roberto-buizza-affiliate-department-excellence>) and **Mario Enrico P ** and **Matteo Dell'Acqua**, also faculty of the Life Science Institutes, in June 2020 (<https://www.embeds.santannapisa.it/news/we-welcome-prof-enrico-pe-and-dr-matteo-dellacqua-affiliates-department-excellence>). Buizza, P  and Dell'Acqua are involved in several collaborations with faculty and researchers in IdE and CoMoS – concerning climate change, its impact and various aspects of sustainability and sustainable development (with a focus on crops and African countries).



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

Outside Sant'Anna, in October 2020 we affiliated **Marco Tedesco** from Columbia University and **Guido Cervone** from Penn State University (<https://www.embeds.santannapisa.it/news/we-welcome-prof-guido-cervone-and-prof-marco-tedesco-affiliates-department-excellence>), and in November 2020 **Sergio Bolasco** from the University of Rome *La Sapienza* and **Giovanni De Gasperis** from the University of L'Aquila (<https://www.embeds.santannapisa.it/news/we-welcome-prof-sergio-bolasco-and-prof-giovanni-de-gasperis-affiliates-department-excellence>). Tedesco and Cervone, too, are involved in several climate change-related projects with IdE and CoMoS – where they provide critical geoinformatics and remote sensing expertise. Bolasco and De Gasperis collaborate with faculty in IdE on text mining and the development of the TalTac software.

8. EDUCATION- AND RESEARCH-RELATED ACTIVITIES: NEW COURSES

In 2020 EMbeDS started actively promoting the development and coordination of courses related to its core research mission. These include courses on programming and data processing, which build upon a Python course first offered by Andrea Vandin and Daniele Licari to students of the Sant'Anna School in the Spring of 2020, and courses on statistical methods, which build upon prior courses offered at the School by F. Chiaromonte – stressing applications to large contemporary datasets.

In the second semester of a.y. 2020-21, we were able to offer a sequence of four coordinated courses entitled **Statistics, Computing & Data Processing** (descriptions and materials at <https://github.com/EMbeDS-education/StatsAndComputing20202021/wiki>). Due to the COVID-19 epidemic, the courses were held in blended mode, or entirely online, using modern e-learning technologies and implementing an innovative experiential approach to online learning. They saw a large enrollment by undergraduate and graduate students of the Sant'Anna School, as well as by students from other programs in the Pisan academic community.

- **Applied Statistics** (Chiara Seghieri), which provided a 10-hours review of basic statistical concepts and linear and generalized linear models.
- **Topics in Statistical Learning** (Francesca Chiaromonte and Jacopo di Iorio), which through two modules of 20 and 10 hours, respectively, introduced the students to various topics in contemporary Statistical Learning (clustering, unsupervised and supervised dimension reduction, classification, smoothing, cross-validation, resampling, regularization and feature selection) – with a focus on hands-on data analysis work, Practicum sessions held in R, and group projects.
- **Introduction to Programming and Data Processing** (Andrea Vandin and Daniele Licari), which through two modules of 20 and 10 hours, respectively, introduced the students to structured computer programming and various data processing techniques (manipulation and visualization) using Python as reference language.
- **Statistical Methods for Large, Complex Data** (Francesca Chiaromonte and Andrea Vandin), which with 14 additional hours, described contemporary approaches to the analysis of high dimensional, ultra-high dimensional, and ultra-large datasets – including those characterized by internal structures and imbalances.

Introduction to Programming and Data Processing, by Andrea Vandin and Daniele Licari, was also held in different formats for the PhD Program in Computer Science at GSSI Gran Sasso Science Institute of L'Aquila (<https://github.com/EMbeDS-education/IPDPP-GSSI-20202021>) and for Italian companies through the



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

ARTES4 Industry 4.0 Competence Center (www.artes4.it/-/iproda-introduction-to-programming-and-data-analysis-in-python). This helped develop "gamified" quizzes for self-assessment and monitoring of the learning process, automatically tested coding exercises to provide hands on experience, integrated teaching material (slides and executable code in a single document), and various applications and examples. We plan to further refine and expand the courses and modules offered in the Statistics, Computing & Data Processing sequence in a.y. 2021-22.

9. INTERACTIONS AND AGREEMENTS WITH INSTITUTIONAL AND PRIVATE SECTOR PARTNERS

EMbeDS' mission includes the transfer and dissemination of knowledge produced by research to policy makers and private sector actors, to support their decision processes and achieve a significant impact on society. Concerning interactions with stakeholders (institutional and private sector) and the strengthening of our role in the Data Science and Artificial Intelligence community (local, national and international), after the implementation of the agreement between CNR, IMT, UNIPI, SSSA and SNS for the creation of the *HUB in Data Science & AI* in Pisa, and the agreement between SSSA and the Court of Genoa as part of the Predictive Justice project, both stipulated in 2019, we worked on several other initiatives in 2020. Among them:

- CINECA HPC: A three-year agreement with CINECA providing access to top-notch High-Performance Computing infrastructure, coordinated by Andrea Vandin.
<https://www.embeds.santannapisa.it/news/andrea-vandin-coordinates-agreement-major-hpc-provider-cineca>
- CBDAI: Agreement (approved in July 2020) among the Tuscany Region, CNR, IMT, SNS, SSSA, University of Florence, University of Pisa and University of Siena, to establish a new Regional Center for research, training and technology transfer on Big Data & Artificial Intelligence (CBDAI) in implementation of the Industry 4.0 Regional Strategy and the Regional Digital Agenda.
- PagoPA: Agreement between PagoPA and IdE SSSA (February 2021) to support the mission of PagoPA and that of the School through initiatives such as the funding of PhD fellowships, research grants, post-graduate scholarships and research contracts.
- COURT OF PISA: Agreement between the Court of Pisa and SSSA (currently being finalized) to utilize skills and techniques developed within the Predictive Justice project to analyze decision-making processes through the application of machine learning systems to legal materials subject to civil litigation.
- Several operational agreements for scientific collaboration and funding of postdoctoral fellowships, e.g., between IdE SSSA and the "Antonio Ruberti" Institute of Systems Analysis and Computer Science of CNR (December 2020; within the framework of the general Agreement between SSSA and CNR of May 2020), and between IdE SSSA and the Pennsylvania State University - Department of Statistics (July 2020).

The EMbeDS community also engaged in institutional and professional networks through a variety of initiatives. For instance, several of our members participated in the **Covid 19 taskforce of the Italian Ministry for Technological Innovation**. The taskforce, established in March 2020, explored and evaluated data-driven policies and digital solutions to address the health, social and economic emergency linked to the spread of the SARS-CoV-2 virus on the Italian territory. It included 74 experts divided into eight working groups, which



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

produced and posted reports (<https://innovazione.gov.it/notizie/articoli/task-force-dati-le-relazioni-delle-attivita-dei-gruppi-che-hanno-valutato-le-app/>).

Finally, members of our community interacted with institutional and private sector partners through various events linked to ongoing projects. Among them:

- **Mission-oriented innovation in a time of COVID-19.** 15 December 2020. In this online event, GROWINPRO researcher and UCL IIP Director, Mariana Mazzucato reflected with IIPP partners from around the world on an extraordinary year and how it affected the governments of the UK, Italy and South Africa.
- **The socio-economic consequences of the COVID-19 pandemic. Modelling, empirics and policy designs.** 2 December 2020. This online conference collected and presented research outputs by the GROWINPRO consortium on analyses and policy guidelines to tackle the COVID-19 crisis.
- **The macroeconomics of COVID-19 crisis.** 11 June 2020. In this online webinar, Lucrezia Fanti (INAPP) Francesco Lamperti (SSSA) and Andrea Roventini (SSSA) discussed macroeconomic policies during the COVID-19 crisis (webinar).
- **Il Fisco del futuro: nuove tecnologie, semplificazione tributaria e lotta all'evasione.** 30 January 2020. This workshop, organized as part of the public engagement activities of the H2020 GROWINPRO project and the EMbeDS Department of Excellence, included as speakers Maria Cecilia Guerra (MEF), Pasquale Tridico (INPS), Giuseppe Virgone (PagoPA) and several Sant'Anna faculty members.
<https://www.embeds.santannapisa.it/news/il-fisco-del-futuro-nuove-tecnologie-semplificazione-tributaria-e-lotta-all%E2%80%99evasione-workshop>
- **Business models for circular economy's financing.** 15 October 2020. This public conference, held in collaboration with the European Commission representative office in Milan and the Forum for Sustainable Finance, explored financial instruments to promote circularity and some recent innovative cases of circular business models in Italy, in order to identify barriers and enabling factors.
- **The green economy in the Alps: beyond the Winter Olympics.** 15 September 2020. This seminar, held in collaboration with the Ministry of the Environment and EURAC, explored the development and economic growth of Alpine regions, presenting a study carried out by GREEN - Bocconi University, and discussing long term opportunities linked to the forthcoming 2026 Olympics in Milan.

10. INFRASTRUCTURE: HIGH-PERFORMANCE COMPUTING CLUSTER

Consistent with the significant investments in hardware, software, and database infrastructure envisioned in the project, a number of acquisitions were finalized during 2020.

After a careful analysis of the needs of faculty, researchers and students carried out in 2018, and in coordination with the ICT (Information and Communication Technology) unit of SSSA, in 2019 we planned and carried out administrative procedures for the acquisition of a new **HPC CLUSTER**. The cluster has high performance specificity and network disk space; it provides broad and flexible service while enabling the newest forms of computation based on the use of GPUs (Graphics Processing Units). The procurement process for the acquisition of the cluster (<https://www.santannapisa.it/it/gare-appalto/procedura-aperta-affidamento-della-fornitura-di-cluster-computazionale-supperto-delle>) was completed in September 2019. The hardware was delivered between September and December 2019 and the testing was completed in early



2020. It included two DELL PowerEdge R740 high-performance, multi-core/multi-gpu nodes connected to a Storage Area Network for high performance and/or "reliability", interconnected in a star topology with a ToR switch. The cluster is managed using the VMware virtualization middleware layer to optimize utilization and dynamically share computing resources.

For the second phase of HPC acquisitions, we further analyzed the needs matured by researchers (after nine months of usage of the cluster) and the research objectives of EMbeDS. We thus planned enhancements comprising:

- a stand-alone Server for public services (separated from the HPC Cluster for security reasons)
- network equipment for fault tolerance and increased connectivity
- increased RAM memory on existing nodes
- a High Computational Density node

The acquisition was subdivided into three lots, where each lot depended on deliverables of the previous one and corresponded to a specialization of the components. We consolidated the IT infrastructure making it fault-tolerant and able to offer new functionalities in support of different types of research projects (utilities, memory-intensive, CPU-intensive).

The first lot comprised **RAM** to upgrade the performance of the two previously acquired computational nodes, and two **Switches** (one for redundancy) for connectivity to the Storage Area Network of the Sant'Anna School (this network equipment enhances connectivity between the Storage Dell Compellent and the computational nodes). The main technical specifications are as follows:

- 2 SAN Dell EMC Connectrix DS-6610B 24x Fibre channel Ports (+SFPs).
- 24 32GB DIMM, 2933MT/s, Dual Rank

The second lot enhanced the EMbeDS HPC infrastructure by introducing a new **high computational density node** integrated with the VMware vSphere 6.7U3 virtualization system. The new computational server enables support for memory-intensive applications and has the following features:

- DELL PowerEdge R840 Rack Server
 - 4x Intel® Xeon® Gold 6252 2.1G, 24C/48T, 10.4GT/s, 35.75M Cache, Turbo, HT (150W) DDR4-2933
 - 24x32GB 2933MHz DIMM modules
 - 8X 2.5 SAS/SATA Chassis - 4 x 960GB SAS SSDs

Finally, the last lot comprised an **Ethernet Switch** for network redundancy and a **Stand-alone Server** to support research projects of the Department of Excellence that expose public services. The main technical specifications are as follows:

- 1 Network Switch (TOR switch) Dell EMC Switch S4128F-ON, 1U, 28 x 10GbE SFP+, 2 x QSFP28, IO to PSU, 2 PSU, OS10
- StandAlone Server Dell PowerEdge R6525
 - 2xAMD EPYC 7452 2.35GHz, 32Cores (tot. 64 Cores)
 - 16x16GB RDIMM, 3200MT/s (tot. 256 GB RAM)
 - 6x2.4TB 10K RPM SAS 12Gbps Hard Drive in RAID 5 (tot. 12 TB)



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

11. INFRASTRUCTURE: DATA BASE AND SOFTWARE ACQUISITION

In 2020 EMbeDS acquired several databases and software critical to its scientific and educational mission. In particular:

- 03/2020. **ORBIS and ZEPHYR** provided by Bureau van Dijk. ORBIS contains rich, comprehensive and standardized data on over 280 million companies across the globe. ZEPHYR contains up-to-date information on M&A, IPO, private equity and venture capital deals and rumours. Some training sessions were also provided by BvD to our community (<https://www.embeds.santannapisa.it/news/webinar-orbis-ip-database>).
- 11/2020. **Crunchbase** provided by Crunchbase Inc. Crunchbase is a database of innovative companies, providing comprehensive information on start-up activity and financing within and across countries. It comprises data on technology companies, key people, investors, types of investors, funding rounds, types of funding, acquisitions and events (<http://embeds.santannapisa.it/news/crunchbase-now-available>).
- 11/2020. **Qualtrics**. Qualtrics is an online survey software to design surveys with drag-and-drop tools, powerful logic, 100+ question types, and pre-built survey templates (<https://www.qualtrics.com/core-xm/survey-software/>).
- 11/2020. **Nvivo**. Nvivo is a software comprising qualitative data in the context of research on maternal and child health. Nvivo is used for the analysis of the questionnaires of the systematic survey on the birth path that involves women from the beginning of pregnancy, up to one year of age of the child and for the analysis of in-depth interviews.
- 11/2020. **SHDB**. SHDB is a database identifying social risks in supply chains through data classified by country and sector, and methodology for quantifying social impacts. SHDB provides insight into social hotspots in product supply chains, covering 140 countries and regions and 57 economic sectors. The database includes an extensive list of indicators on labour rights, health and safety, human rights, governance, and community infrastructure.
- 12/2020. **NRG METRICS**. NRG METRICS provides a database on board members compensation comprising 22 countries for the period 2011-2019 and covering over 5200 listed companies. The compensation data includes more than 50 variables concerning executives compensation, directors compensation, ownership guidelines, compensation consultants, non-executive fees and CEO pay ratio.

The databases and software licenses are available to all faculty, researchers and students in our community, as well as collaborators from other institutions, through the Library of the Sant'Anna School. We plan to continue securing access to critical data sources in 2021 and beyond.

12. RECRUITMENT: ASSOCIATE AND ASSISTANT PROFESSORS

In 2020 EMbeDS recruited a number of new faculty. In particular:

- 12/2020. **Sabina De Rosi** joined the Institute of Management of Sant'Anna School and EMbeDS as an **Assistant Professor (RDT-A)** in Management – Management and Healthcare Laboratory (MeS). <https://www.embeds.santannapisa.it/news/sabina-de-rois-assistant-professor-management-rtd-joins-embeds>



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

- 09/2020. **Laura Magazzini** joined the Institute of Economics of the Sant'Anna School of Advanced Studies and EMbeDS as **Associate Professor** in Econometrics.
<https://www.embeds.santannapisa.it/news/laura-magazzini-associate-professor-econometrics-joins-embeds>
- 05/2020. **Paola Cantarelli** joined the Institute of Management and EMbeDS as an **Assistant Professor (RDT-A)** in Management – Management and Health Laboratory (MeS).
<https://www.embeds.santannapisa.it/news/paola-cantarelli-assistant-professor-management-rtd-joins-embeds>

An additional recruitment took place in early 2021, and will be formally reported in the 2021 monitoring:

- In 03/2021. **Gaia Bertarelli** joined the Institute of Management and EMbeDS as an **Assistant Professor (RDT-A)** in Social Statistics.
<https://www.embeds.santannapisa.it/news/gaia-bertarelli-assistant-professor-management-rtd-joins-embeds>

13. RECRUITMENT: POSTDOCTORAL FELLOWS

In 2020 EMbeDS also co-financed a number of new postdoctoral fellows. In particular:

- 01/2020. **Stefania Manetti** joined the Institute of Management and EMbeDS as a Research Fellow working at the Management and Health Laboratory on *Economic sustainability of public health systems*.
<https://www.embeds.santannapisa.it/news/stefania-manetti-joins-institute-management-and-embeds-research-fellow>
- 03/2020. **Serena Carlesi** joined the Institute of Management and EMbeDS as a Research Fellow working on *Circular economy and business competitiveness*.
<https://www.embeds.santannapisa.it/news/serena-carlesi-joins-institute-management-and-embeds-research-fellow>
- 07/2020. **Irene Martelli** joined the Institute of Management and EMbeDS as a Research Fellow working on *Statistical Analysis for data science applications in Open Innovation Strategy*.
<https://www.embeds.santannapisa.it/news/irene-martelli-joins-institute-management-and-embeds-research-fellow>
- 09/2020. **Jacopo di Iorio** joined the Institute of Economics and EMbeDS as a Research Fellow working on *Functional Data Analysis and Statistical Learning techniques for the study of Big Data in Economics*. His position is co-financed by EMbeDS and the Pennsylvania State University.
<https://www.embeds.santannapisa.it/news/jacopo-di-iorio-research-fellow-statistics-joins-embeds>
- 11/2020. **Mario Martinoli** joined the Institute of Economics and EMbeDS as a Research Fellow working on *Empirical Evaluation and Validation of Quantitative Models in Economics*.
<https://www.embeds.santannapisa.it/news/mario-martinoli-joins-institute-economics-and-embeds-research-fellow>



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

Additional recruitments took place in early 2021, and will be formally reported in the 2021 monitoring:

- 01/2021. **Giorgio Tripodi** joined the Institute of Economics and EMbeDS as a Research Fellow working on *Analysis of key technologies for the Green New Deal, knowledge flows between them, and emerging technological trajectories using scientific publication and patent data*.
<https://www.embeds.santannapisa.it/news/giorgio-tripodi-joins-institute-economics-sant%E2%80%99anna-school-and-embeds-research-fellow>
- 03/2021. **Matteo Coronese** joined the Institute of Economics and EMbeDS as a Research Fellow working on *Models with heterogeneous agents for the study of the coevolution of climate change and land use*.
<https://www.embeds.santannapisa.it/news/matteo-coronese-joins-institute-economics-and-embeds-research-fellow>
- 04/2021. **Luca Insolia** joined the Institute of Economics and EMbeDS as a Research Fellow working on *Integer and mixed optimization techniques for feature selection and robust estimation in high dimensional data*. His position is co-financed by EMbeDS and IASI-CNR.
<https://www.embeds.santannapisa.it/news/luca-insolia-joins-institute-economics-and-embeds-research-fellow>

14. MANAGEMENT, MONITORING AND PLANNING ACTIVITIES

The MANAGING BOARD of EMbeDS was formed in January 2018 and comprises:

- [Francesca Chiaromonte](#) is the *Scientific Coordinator of EMbeDS*. At Sant'Anna, she is a Full Professor of Statistics in the Institute of Economics, and the internal referent for the consortium PhD in Data Science. She also teaches Statistics and directs the Institute for Genome Sciences (one of the Huck Institutes) at the Pennsylvania State University. She develops methods for the analysis of large, high-dimensional and complex data, and applies such methods in several scientific fields – including contemporary “Omics” sciences, Meteorology and Economics. She holds a PhD in Statistics from the University of Minnesota (USA) and a Laurea in Statistics and Economic Sciences from the University of Rome La Sapienza. She is a Fellow of the American Statistical Association.
- [Andrea Piccaluga](#) is a Full Professor of Innovation Management and the *Director of the Institute of Management*. In addition, he is the President of Netval (www.netval.it), the Italian network of University Technology Transfer Offices, and has launched the DBA programs at Sant'Anna (www.dba.idm.sssup.it). He holds a PhD from Sant'Anna and a Master in Technology and Innovation Management from SPRU (University of Sussex, Brighton UK).
- [Alessandro Nuvolari](#) is a Full Professor of Economic History and *Director of the Institute of Economics*. Prior to becoming director, he was the coordinator of the PhD program in Economics at Sant'Anna. A graduate of Bocconi University with a PhD in Economics from the Eindhoven University of Technology (Netherlands), his research is focused on the role played by science and technology in the emergence and consolidation of economic growth both in historical and contemporary contexts.
- [Fabio Iraldo](#) is a Full Professor of Environmental Management and he is in charge of EMbeDS' *relationships with stakeholders*. He is the coordinator of the PhD program in Management at Sant'Anna. His principal research areas include Corporate Environmental Management, Life-Cycle Management, Economics and Management of Voluntary Certification Schemes, Environmental Innovation and



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

Competitiveness, Sustainable Marketing, Environmental Reporting, and Stakeholder Engagement. He holds a Laurea from the Bocconi University and a PhD in Economics from the University of Venice.

Following changes in the University leadership, the new Director General and Rector of the School have replaced the prior ones in 2020 as members of the board:

- [Alessia Macchia](#) is the new *Director General of Sant'Anna*. She graduated in Business Economics from the University of Pisa and obtained a PhD from Sant'Anna, after which she gained extensive experience in the public administration sector and in HR management. In particular, she served as Administrative Director of the USL 2 Lucca Health Unit (2012-2015) and as Director of Human Resources Management of the USL Toscana Nord Ovest Health Unit, managing over 13,200 employees.
- [Sabina Nuti](#) is Full Professor of Health Management at the Institute of Management, coordinator of the Management and Health Laboratory, and the new *Rector of Sant'Anna*. Her research concerns performance evaluation systems, efficiency and governance mechanism in health care. She coordinates the Interregional performance evaluation systems (<http://performance.sssup.it/netval>), has been a member of Expert Panels and Joint Assessment Frameworks for the European Commission, and is a member of the Scientific Committee of the National Outcome Program of the National Italian Agency for Regional Health Services.

As in 2018 and 2019, the Managing Board held approximately monthly meetings through 2020 (15.01.20, 25.02.20, 26.03.20, 05.05.20, 16.06.20, 10.09.20, 23.10.20, 09.12.20) and formed task forces – comprising also other faculty and personnel of the School – to plan and advance various initiatives. In particular, two *Associate Scientific Coordinators* regularly participate to Managing Board meetings and contribute to all aspects of planning and implementation:

- [Andrea Mina](#) is Associate Professor of Economics at the *Institute of Economics of Scuola Superiore Sant'Anna*. Until October 2016 he was University Lecturer in Economics of Innovation at the Cambridge Judge Business School, of which he is now a Research Fellow. In Cambridge he was also Senior Research Associate of the Centre for Business Research and Director of Economic Studies and Fellow of St Edmund's College. He is now Pro-Rector for International Relations of Scuola Superiore Sant'Anna.
- [Nicola Bellè](#) is Assistant Professor at the *Institute of Management of Scuola Superiore Sant'Anna*. His research focuses on behavioral human resource management. Prior to joining the Sant'Anna School, Nicola was an assistant professor at Bocconi University and a faculty member of the SDA Bocconi School of Management, where he used to serve as the managing editor of the Observatory on Change in Public Administration. Nicola holds a Ph.D. in Public Administration and Management from the University of Parma.

Finally, in 2020 as before, EMbeDS operated in close coordination with other units of the Sant'Anna School, in particular the **ICT Services** directed by [Italo Lisi](#), who is actively involved in infrastructure acquisition and related coordination and training initiatives; the **Library**, where Maria Teresa Navigato and Carla Papa are involved in the acquisition and management of databases access; the **Purchasing Office**; the **Human Resources Office**; the **Technical Area Office** and the **Communication Office**. We also work closely with the faculty and the coordinator of the **PhD in Data Science** [Dino Pedreschi](#) (UniPi). Finally, we are establishing



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

collaborative ties with the **Department of Excellence Robotics & AI** of Sant'Anna and with the **Scuola Normale Superiore** on the acquisition and joint use of computational infrastructure and databases, as well as other initiatives.

15. ONLINE PRESENCE AND MEDIA COVERAGE

WEBSITE:

We designed and implemented a website to collect information on EMbeDS and its members, and specific news and events relevant to our scientific and educational aims (<http://embeds.santannapisa.it/>). Relatedly, we developed a logo and graphic design for the Department of Excellence – which is used on the website, as well as in printed and online materials. The website is a key communication tool that allows us to reach a broad community and advertise our initiatives, activities and progress. It is in constant evolution, and at this time it includes the following sections:

- WHO ARE WE? (profiles of people in leadership, extended community, recruits and administrative roles)
- OPENINGS (active calls and calls for expressions of interest)
- RESEARCH (description of main research areas, and of the challenges and opportunities of Big Data)
- EDUCATION (description of the PhD programs related to EMbeDS)
- IMPACT (description of the socio-economic impact of our research)
- PRIVATE SECTOR (summary of connections with the private sector and relations with stakeholders)
- NEWS (news concerning salient activities, workshops, papers, visitors, recruitment, databases, etc.)
- EVENTS (description, scheduling and locations of events relevant to the EMbeDS community)
- ANNUAL REPORTS (where the Annual Reports for 2018 and 2019 are posted)
- EMbeDS 2019 WORKSHOP (registration and detailed program of the EMbeDS 2019 Workshop)
- INFRASTRUCTURE RESOURCES (description of the EMbeDS High-Performance Computing Cluster and the EMbeDS Multi-Function Laboratory)
- COVID-19 (a new section **added in 2020**, which showcases a selection of relevant readings linked to the pandemic – including contributions by our community; a selection of relevant scientific literature repositories; a selection of relevant data repositories and data integration platforms and dashboards; and a selection of round tables, seminars, workshops and documentaries).

MEDIA COVERAGE

Scientific output, contributions and events related to the EMbeDS community were presented in press releases and featured in various media outlets in 2020 and in the early months of 2021. Below we provide a selection of such coverage:

- Lo studio: così gli scienziati scelgono i temi delle loro ricerche. Firenze Repubblica.it <https://www.ow9.rassegnestampa.it/SistemaUniversitarioPisanoRassegnaStampa/PDF/2020/2020-09-01/2020090162219296.pdf>
- Come gli scienziati scelgono i temi delle loro ricerche. Gonews.it



Department
of Excellence
2018 - 2022

EMbeDS

Economics and Management
in the era of Data Science

<https://www.ow9.rassegnestampa.it/SistemaUniversitarioPisanoRassegnaStampa/Get.ashx?pdf=PDF/2020/2020-09-01/2020090140319321.pdf&evid=EMBEDS®=c49f96ad-c66f-4ca6-af68-6b24d11a672b>

- Come si orientano le scelte degli scienziati, ecco i fattori che guidano scoperte scientifiche e tecnologiche. Info salute news.it
<https://www.ow9.rassegnestampa.it/SistemaUniversitarioPisanoRassegnaStampa/Get.ashx?pdf=PDF/2020/2020-09-01/2020090140400934.pdf&evid=EMBEDS®=c49f96ad-c66f-4ca6-af68-6b24d11a672b>
- Lotta all'evasione rispettando la privacy: convegno sul futuro del fisco. Gonews.it
<https://www.ow9.rassegnestampa.it/SistemaUniversitarioPisanoRassegnaStampa/Get.ashx?pdf=PDF/2020/2020-01-28/2020012824810158.pdf&evid=EMBEDS®=c49f96ad-c66f-4ca6-af68-6b24d11a672b>
- Il fisco del futuro: convegno al Sant'Anna di Pisa. Gonews.it
<https://www.ow9.rassegnestampa.it/SistemaUniversitarioPisanoRassegnaStampa/PDF/2020/2020-01-30/2020013084411273.pdf>
- Prospettive economico finanziarie e ipotesi patrimoniale: l'analisi di Andrea Roventini, docente all'istituto di Economia della Scuola Sant'anna Di Pisa. LA7
<https://www.santannapisa.it/it/multimedia/la7-prospettive-economico-finanziarie-e-ipotesi-patrimoniale-lanalisi-di-andrea-roventini>
- Emergenza sanitaria ed economica, tra recovery fund in arrivo e crisi di fiducia dei consumatori: il contributo di Andrea Roventini, docente all'istituto di Economia della Scuola Sant'anna Di Pisa. CLASS CNBC
<https://www.santannapisa.it/it/multimedia/class-cnbc-emergenza-sanitaria-ed-economica-tra-recovery-fund-arrivo-e-criasi-di-fiducia>
- Covid-19: Toscana in zona rossa, le prospettive per l'economia oltre l'emergenza: l'analisi di Andrea Roventini, docente all'Istituto di Economia della Scuola Sant'Anna di Pisa. RTV38
<https://www.santannapisa.it/it/multimedia/rtv-38-covid-19-toscana-zona-rossa-le-prospettive-leconomia-oltre-lemergenza-lanalisi-di>
- Cambiamenti climatici e impatto economico: il contributo di Francesco Lamperti, ricercatore all'istituto di Economia della Scuola Sant'anna Di Pisa. Grand Ducato TV
<https://www.santannapisa.it/it/multimedia/gran-ducato-tv-cambiamenti-climatici-e-impatto-economico-il-contributo-di-francesco>
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