

## PERSONAL INFORMATION

## Roberto Sala



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Gender Male | Nationality Italian

## RESEARCH EXPERIENCE

May 2022 – Present

**Research Fellow - STARS program**

University of Bergamo, Italy

Research fellow contract, part of the UniBg STARS program, titled "Sviluppo di un sistema di prognostica a supporto dell'ingegneria di manutenzione basato di modelli di Digital Twin". The project had the objective of developing Digital Twin models able to favour augmented decision-making for the delivery of maintenance, and related services, in the manufacturing context. The activity required: 1) an analysis of the literature on the topic, 2) an analysis of framework in support of the development of digital twin models, 3) the development of decision-making tools that, combined with the digital twin, could beneficially impact the operational decision-making for maintenance delivery. Scientific responsible: Prof. Giuditta Pezzotta.

January 2022 – April 2022

**Research Contract**

University of Bergamo, Italy

Project entitled "Sviluppo di un modello di simulazione ibrida del processo di erogazione della manutenzione". The project consists of three main phases: 1) Analysis of hybrid simulation models, 2) Development of the hybrid simulation model, 3) Validation of the model in an industrial context. The project involves the use of AnyLogic software, which allows the simultaneous use of hybrid simulation and discrete event simulation, which are ideal for modeling the process under consideration. From the industrial perspective, the project focuses on the analysis of the maintenance service delivery process of a manufacturing company. Scientific responsible: Prof. Matteo Kalchschmidt.

November 2021 – December 2021

**Research contract**

University of Bergamo, Italy

The collaboration involved a coaching activity to be carried out with one of the participants in the Digital Manufacturing Transformation 2021 executive program. The activity, carried out over the course of 8 hours, has provided supervision with respect to an improvement project to be made in the company. Specifically, the activity involved the analysis of different techniques and methods of production scheduling with the aim of increasing the saturation of operators and machinery and, at the same time, reducing the number of orders delivered late. Course responsible: Prof. Sergio Cavalieri.

October 2021 – December 2021

**Research Contract**

University of Bergamo, Italy

Project in collaboration with ABB S.p.A entitled "Analysis of robot failure data". The activity focused on the analysis of the failure data of the robots with the aim of identifying causes and correlations. At the same time, an analysis at the reliability level was also carried out with the aim of identifying failure trends. From the operational point of view, the analysis were carried out through the use of software like Microsoft Excel and Microsoft Power BI in conjunction with the use of Python programming language. Responsible of the project: Prof.ssa Giuditta Pezzotta.

October 2020 – September 2021

**Research Fellow**

University of Bergamo, Italy

Research fellow contract titled "Il ruolo delle tecnologie digitali nei processi operativi delle filiere logistiche". The project had the objective of analysing business operational processes with particular focus on the role of digital technologies to support their management and decision-making activities. The activity required: 1) an analysis of the literature on technologies in the field of logistics, 2) an analysis of decision-making tools to support operational processes impacting the field of logistics. Scientific responsible: Prof. Sergio Cavalieri.

June 2021 – June 2021 **Research contract**

University of Bergamo, Italy

Project titled "Consulenza tecnico-scientifica relativa alla sperimentazione e valutazione dell'applicazione SIMVSM (Value Stream Mapping)". The objective of the project was to identify the main vendors of VSM mapping solutions and to evaluate the different applications on the basis of a set of variables related to the usability of the software and its applicability in real contexts. Scientific responsible: Prof. Paolo Gaiardelli.

November 2020 – December 2020 **Research contract**

University of Bergamo, Italy

Project titled "Supporto nell'analisi degli attuali metodi di pianificazione e gestione della produzione e definizione degli interventi di miglioramento". The project had as objective the analysis of the production planning process of the company Ebera srl with the aim of identifying the criticalities and define a subsequent proposal for improvement using both methodological tools and the support of digital tools. Scientific responsible: Prof. Fabiana Pirola.

October 2017 – September 2020 **PhD in Technology, Innovation and Management**

University of Bergamo and University of Naples Federico II, Italy

Technology, Innovation and Management doctoral program. The research project aimed at developing a framework to support human decision-makers in the data-driven PSS delivery with a special focus on maintenance delivery. Tutor: Prof. Sergio Cavalieri. Co-Advisors: Prof. Giuditta Pezzotta and Prof. Fabiana Pirola.

October 2019 – October 2019 **Research contract**

University of Bergamo, Italy

Project titled "Implementazione del metodo Product Service Concept Tree (PSCT) per l'identificazione di nuove idee di servizio". The objective of the project was to identify new services to be offered to customers by SMI S.p.A. The main tool used during the activity was the Product Service Concept Tree (PSCT). The analysis focused mostly on the identification of new maintenance services. Scientific responsible: Prof. Fabiana Pirola.

October 2018 – January 2019 **Research contract**

University of Bergamo, Italy

Project titled "Scheduling della produzione di IV Gamma". The project had as objective: 1) the analysis, at literature level, of the different scheduling approaches, 2) the analysis of the productive process of the company involved in the FRESHCUT project, 3) the definition of the simulation model of the plant. Scientific responsible: Prof. Roberto Pinto.

July 2017 – September 2017 **Research Fellow**

University of Bergamo, Italy

Research Fellow funded by DIVERSITY project (GA 636692 – Call H2020). The project aims at providing a concurrent collaborative environment for product-service design supporting companies from the context sensitive capturing and searching of knowledge to the transformation of these data into product-service functionalities ([www.diversity-project.eu](http://www.diversity-project.eu)). Scientific responsible: Prof. Sergio Cavalieri

**April 2017 – July 2017 Research Contract**

University of Bergamo, Italy

Project in collaboration within a research project funded by Cotonificio Albini S.p.A. The research activities dealt with the improvement of the stock management process. Scientific responsible: Prof. Sergio Cavalieri

**April 2016 – March 2017 Research Scholar**

University of Bergamo, Italy

- CAREL Spa funded project. The research activities consisted in the supervision in the definition of new PSS offering related to the company evolution in the era of Industry 4.0 and in the definition and adoption of structured methodology to support the servitization process of the company. Scientific responsible: Prof. Giuditta Pezzotta.
- Bergamo Tecnologica funded project. The project funded by Bergamo Tecnologica was mainly focused on the improvement of the production process of SALF spa (namely SALF project). The research activity concerned the analysis of the production process through an initial mapping of the different activities, the identification of the main issues and the proposal of suitable solutions for the identified problems in the area of production planning and control.
- Support in the project proposal writing for European and regional calls

## LECTURING EXPERIENCE

October 2016 – Present **Lecturing Support Activities**

University of Bergamo, Italy

The activity deals with the support in the theoretical and practical lectures related to the Value Stream Mapping lean tool. In addition, the activity concerns the conceptualization and writing of a teaching case study related to the Value Stream Mapping for the courses of "Corso integrato di Gestione delle Operations e Sistemi integrati di produzione" (ID code: 37041) and "Operations Management and Supply and Service Chain Management" (ID code: 37154-ENG1) held by Prof. Sergio Cavalieri, Prof. Giuditta Pezzotta, and Prof. Fabiana Pirola. The case study is based on the identification of the problems related to an imaginary manufacturing process and the related improvement using the lean tools seen during the course.

February 2019 – Present **Lecturing Support Activities**

University of Bergamo, Italy

The activity deals with the support in the exercise lectures and the conceptualization and writing of a teaching case study for the courses of "Gestione della Produzione Industriale" 9 CFU (ID code: 22017) and 6 CFU (ID code: 21033) held by Prof. Giuditta Pezzotta and Prof. Fabiana Pirola. The case study is based on the identification of the problems related to an imaginary manufacturing production process and the related improvement using the methods and tools seen during the course.

February 2019 – Present **Lecturing Support Activities**

University of Bergamo, Italy

The activity deals with the support in the theoretical and practical lectures for the courses of "C.I. Simulation techniques in healthcare process (Healthcare Operations)" (Cod. 148005) held by Prof. Fabiana Pirola and Prof. Sergio Cavalieri.

February 2022 – February 2022 **Lecturing contract**

University of Bergamo, Italy

A 3-hour seminar on the topic of Product-Service Systems (PSS) for the PhD in Technology, Innovation, and Management (TIM). The content of the seminar includes an overview of the topic of PSS ranging from its origins to recent developments, with particular attention to the integration of technologies characterizing Industry 4.0 within the PSS offerings.

January 2017 – February 2022 **Lecturing contract**

Fondazione di Partecipazione dell'Istituto Tecnico Superiore "Area Tecnologica della Mobilità Sostenibile – Logistica e Sistemi e Servizi Innovativi per la Mobilità di Persone e Mercè", Italy

The training activity is divided between the first and second year of the course. For the first year of course the activity (16 hours in total) is focused on the theory and relative practice to the production and service process mapping. Specifically, the training focuses on modeling languages such as ARIS and Service Blueprinting, allowing an overview of the differences and use cases for each modelling language. For the second year of the course (about 12 hours), the training deals with the theme of Value Stream Mapping (VSM). VSM is a mapping methodology related to the Lean Manufacturing approach that allows to highlight value-added and non-value-added activities in company processes. This mapping methodology stimulates critical thinking on possible improvements to be made at the level of the production process for the company.

## EDUCATION AND TRAINING

October 2017 – March 2021

**PhD in Technology, Innovation and Management**

University of Bergamo and University of Naples Federico II, Italy

Technology, Innovation and Management doctoral program, area CUN 09 - Ingegneria industriale e dell'informazione. The research project aims at developing a framework to support human decision-makers in the data-driven PSS delivery with a special focus on maintenance delivery.

Supervisor: Prof. Sergio Cavalieri

Co-Advisors: Prof. Giuditta Pezzotta, Prof. Fabiana Pirola

Title: A Dual-perspective, Data-based, Decision-making approach to manage the Maintenance service delivery process: the D3M framework

Final mark: Elevato

Graduation date: March 31st, 2021

December 2019 – February 2020

**Visiting Scholar**

Blekinge Institute of Technology, Sweden

The visiting period was aimed at carrying out the research validation of the decision-making framework, and related instruments, developed during the PhD. The results of the visiting period are described in a journal papers written in collaboration with Professor Marco Bertoni, hosting professor during the visiting period.

October 2018 – November 2018

**Visiting Scholar**

The University of Hong Kong, Hong Kong, China

The visiting period was aimed at carrying out the research on decision-making processes and model in the Product-Service System and Industry 4.0 contexts. The results of the visiting period are described in two papers written in collaboration with Professor George Q. Huang, hosting professor during the visiting period.

July 2017

**NEMO Sumer School**

University of Vienna, Austria

The Summer School (From 16/07/2017 to 28/07/2017. Total lecturing/practice hours: 60) focuses on the Enterprise Modelling in the Age of Internet of Things. A special attention was devoted to the modelling methods able to support modelling in the context on Industry 4.0.

October 2013 – April 2016

**Master of Science in Management Engineering**

Polytechnic University of Milan, Italy

Grade: 105/110

Supervisor: Professor Mauro Mancini

Thesis: A Real Option investment model for the wind and photovoltaic plants evaluation

August 2014 – January 2015

**Erasmus+**

Université de Technologie de Compiègne, France

During the period spent in France I had the chance attend four courses focused on the project management and on the creation of innovative start-ups. Besides this I had the chance to attend a course focused on the working relationship and habits in different countries

October 2010 – September 2013

**Bachelor of Science in Management and Production Engineering**

Polytechnic University of Milan, Italy

Grade: 88/110

Supervisor: Uros Sikimic

Thesis: Business Game

**PERSONAL SKILLS**

Mother tongue Italian

Other languages	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	TOEIC C1		
French	B1	B1	UTC Test B1		

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user  
[Common European Framework of Reference for Languages](#)

**Communication skills** Good interpersonal and dialogue skills obtained thanks to the experiences abroad. The participation in multiple projects, with people from different countries used to have different working habits (during the Erasmus+ program, the DIVERSITY project and the NEMO Summer School), helped me developing the capability to relate with them and mitigate possible incomprehension. Also, I was able to create fruitful relation during the writing of project proposal with multiple international partners.

**Organisational / managerial skills** Good work organizational skills acquired during the studies and the projects carried out in Italy and abroad. I strengthen my managerial skills participating in the organization of the 2016 CIPR IPSS Conference held in Bergamo. I was part of the international scientific committee of the 2017 CIPR IPSS conference held in Copenhagen. Moreover, thanks to the participation the DIVERSITY project I had the chance to manage the writing and development of a couple of deliverables and overview the implementation of some of the tools developed in the project. I participated in the writing of different project proposal with a consistent number of partners in each consortium being able to manage the relation with them and to coordinate our work.

**Computer skills**

- Good knowledge of the Microsoft Office suite
- Good knowledge of simulation and modelling software (e.g. Flexsim, Arena, AnyLogic). Simulation and modelling focused on Discrete-Event Simulation, Agent-Based Simulation and hybrid modelling approaches
- Good knowledge of editing software
- Good programming skills in python using packages related to data analysis (e.g. pandas, numPy, scikit-learn) and text-mining (e.g., NLTK, spaCy, gensim)

**Driving licence** B

PUBLICATIONS, WORKSHOPS  
AND CONFERENCESSelected publications in  
proceedings of Peer-Reviewed  
Scientific Conferences

- SALA, R., Pirola, F., Pezzotta, G., Cavalieri, S., 2022. *NLP-based insights discovery for industrial asset and service improvement: an analysis of maintenance reports*. IFAC-Pap., 14th IFAC Workshop on Intelligent Manufacturing Systems IMS 2022 55, 522–527. <https://doi.org/10.1016/j.ifacol.2022.04.247>
- SALA, R., Corona, M., Pirola, F., Pezzotta, G., 2021. *The Machine Learning Algorithm Selection Model: test with multiple datasets*, in: XXVI Summer School “Francesco Turco”–Industrial Systems Engineering. pp. 1–7.
- SALA, R., Pirola, F., Pezzotta, G., Vernieri, M., 2021. *Improving Maintenance Service Delivery Through Data and Skill-Based Task Allocation*, in: IFIP International Conference on Advances in Production Management Systems. Springer, pp. 202–211.
- SALA, R., Pirola, F., Pezzotta, G., 2020. *Data-Driven Maintenance Delivery Framework: Test in an Italian Company*, in: Lalic, B., Majstorovic, V., Marjanovic, U., von Cieminski, G., Romero, D. (Eds.), *Advances in Production Management Systems. Towards Smart and Digital Manufacturing*, IFIP Advances in Information and Communication Technology. Springer International Publishing, Cham, pp. 322–329. [https://doi.org/10.1007/978-3-030-57997-5\\_38](https://doi.org/10.1007/978-3-030-57997-5_38)
- Colli, M., SALA, R., Pirola, F., Pinto, R., Cavalieri, S., Wæhrens, B.V., 2019. *Implementing a dynamic FMECA in the digital transformation era*. IFAC-Pap. 52, 755–760. <https://doi.org/10.1016/j.ifacol.2019.11.206>
- SALA, R., Pezzotta, G., Pirola, F., Huang, G.Q., 2019. *Service Delivery Process improvement using Decision Support Systems in two manufacturing companies*, in: *Procedia CIRP*. Elsevier B.V., pp. 248–253. <https://doi.org/10.1016/j.procir.2019.03.130>
- SALA, R., Pezzotta, G., Pirola, F., Huang, G.Q., 2019. *Decision-Support System-based Service Delivery in the Product-Service System Context: Literature Review and Gap Analysis*, in: *Procedia CIRP*. Elsevier B.V., pp. 126–131. <https://doi.org/10.1016/j.procir.2019.03.140>
- SALA, R., Pirola, F., Dovere, E., Cavalieri, S., 2019. *A Dual Perspective Workflow to Improve Data Collection for Maintenance Delivery: An Industrial Case Study*, in: Ameri, F., Stecke, K., von Cieminski, G., Kiritsis, D. (Eds.), *Advances in Production Management Systems. Production Management for the Factory of the Future*. APMS 2019. Springer, Cham, pp. 485–492. [https://doi.org/10.1007/978-3-030-30000-5\\_60](https://doi.org/10.1007/978-3-030-30000-5_60)
- SALA, R., Zambetti, M., Pirola, F., Pinto, R., 2018. *How to select a suitable machine learning algorithm: A feature-based, scope-oriented selection framework*, in: *Proceedings of the Summer School Francesco Turco*. pp. 87–93.
- Zambetti, M., SALA, R., Russo, D., Pezzotta, G., Pinto, R., 2018. *A patent review on machine learning techniques and applications: depicting main players, relations and technology landscapes*, in: XXIII Summer School “Francesco Turco” – Industrial Systems Engineering. pp. 115–128.
- Sala, R., Zanetti, V., Pezzotta, G., Cavalieri, S., 2017. *The role of technology in designing and delivering Product-service Systems*, in: 2017 International Conference on Engineering, Technology and Innovation (ICE/ITMC). IEEE, Funchal, Madeira Island, Portugal, pp. 1255–1261. <https://doi.org/10.1109/ICE.2017.8280024>
- Sala, R., Sassanelli, C., Pezzotta, G., Terzi, S., 2017. *A comprehensive Engineering Environment to conceptualize, design and monitor Product Service Systems (PSS): an application case*, in: *Proceedings of the Summer School Francesco Turco*. Palermo, Italy.

## Selected publications in Scientific Journals

- SALA, R., Pirola, F., Pezzotta, G., Cavaliere, S., 2022. *Data-Driven Decision Making in Maintenance Service Delivery Process: A Case Study*. Appl. Sci. 12, 7395. <https://doi.org/10.3390/app12157395>
- SALA, R., Bertoni, M., Pirola, F., Pezzotta, G., 2021. *Data-based decision-making in maintenance service delivery: the D3M framework*. J. Manuf. Technol. Manag. 32, 122–141. <https://doi.org/10.1108/JMTM-08-2020-0301>
- Pezzotta, G., Sassanelli, C., Pirola, F., SALA, R., Rossi, M., Fotia, S., Koutoupes, A., Terzi, S., Mourtzis, D., 2018. *The Product Service System Lean Design Methodology (PSSLDM)*. J. Manuf. Technol. Manag. 29, 1270–1295. <https://doi.org/10.1108/JMTM-06-2017-0132>
- Sassanelli, C., Pezzotta, G., Pirola, F., SALA, R., Margarito, A., Lazoi, M., Corallo, A., Rossi, M., Terzi, S., 2018. *Using design rules to guide the PSS design in an engineering platform based on the product service lifecycle management paradigm*. Int. J. Prod. Lifecycle Manag. 11, 91–114. <https://doi.org/10.1504/IJPLM.2018.092826>

## Participation to International scientific committee

- XXVI Summer School Francesco Turco, Bergamo, Italy, September 08-10, 2021
- XXV Summer School Francesco Turco, Bergamo, Italy, September 09-11, 2020
- IPSS Conference 2017, Copenhagen, Denmark, June 19-21, 2017

## Participation to conferences

- 14th IFAC Workshop on Intelligent Manufacturing Systems IMS 2022, Tel Aviv, Israel, March 29-30, 2022
- XXVI Summer School Francesco Turco, Bergamo, Italy, September 08-10, 2021
- APMS Conference 2021, Nantes, France, September 5-9, 2021
- XXV Summer School Francesco Turco, Bergamo, Italy, September 09-11, 2020
- APMS Conference 2020, Novi Sad, Serbia, September 1-5, 2020
- XXIV Summer School Francesco Turco, Brescia, Italy, September 11-13, 2019
- APMS Conference 2019, Austin, Texas, USA, September 1-5, 2019
- IPSS Conference 2019, Hong Kong & Zhuhai, China, May 29-31, 2019
- XXIII Summer School Francesco Turco, Palermo, Italy, September 12-14, 2018
- INCOM2018, Bergamo, Italy, June 11-13, 2018
- XXII Summer School Francesco Turco, Mondello, Italy, September 13-15, 2017
- PLM Conference 2017, Seville, Spain, July 10-12, 2017
- ICE Conference 2017, Funchal, Madeira Island, Portugal, June 27-29, 2017
- Seminar “Industria 4.0: la grande occasione per l’Italia”, Milan, Italy, June 23rd, 2017
- IPSS Conference 2017, Copenhagen, Denmark, June 19-21, 2017
- XXI Summer School Francesco Turco, Naples 13-15 September 2016
- IPSS Conference 2016, Bergamo, Italy, June 19-21, 2016



## Participation to workshops

- PhD On the Go, Online, July 1-2, 2020
- 2nd CoFindus workshop, Online, June, 29, 2020
- 2nd "Technology, Innovation and Management" PhD Programme Doctoral Workshop, Bergamo, Italy, September 24-25, 2019
- APMS Conference 2019 Doctoral Workshop, Austin, Texas, USA, September 1, 2019
- PhD On the Go, Benevento, Italy, May 9-10, 2019
- 1st CoFindus workshop, Torino, Italy, April, 04, 2019
- 1st "Technology, Innovation and Management" PhD Programme Doctoral Workshop, Naples, Italy, October 1-2, 2018
- PALM Doctoral Workshop, Lastra a Signa, Italy, June 14-17, 2018
- PhD On the Go, Salerno, Italy, May 3-4, 2018

## Peer Reviewer Activities

- Cleaner Engineering and Technology
- Computers in Industry
- International Journal of Production Research
- Journal of Manufacturing Technology Management
- Journal of Manufacturing Systems

## Courses

- Course on the Business Model Innovation, June 8-10, 2016, Bergamo, Italy, at quo-d srl
- Applied Text Mining in Python, September 2021, on Coursera, link to certificate: <https://www.coursera.org/account/accomplishments/certificate/NBLWD9TFBQ4U>
- Master MeGMI - Gestione strategica del ciclo di vita degli asset, A.Y. 2020/2022
- Master MeGMI - Ingegneria di manutenzione 1, A.Y. 2020/2022
- Master MeGMI - Ingegneria di manutenzione 2, A.Y. 2020/2022
- Master MeGMI - Sistemi informativi di manutenzione, A.Y. 2020/2022
- Master MeGMI - Strumenti e metodi per la Smart Maintenance, A.Y. 2020/2022

## PERSONAL DATA

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I authorize the processing of my personal information under Legislative Decree 196/03

Bergamo, August 8, 2022