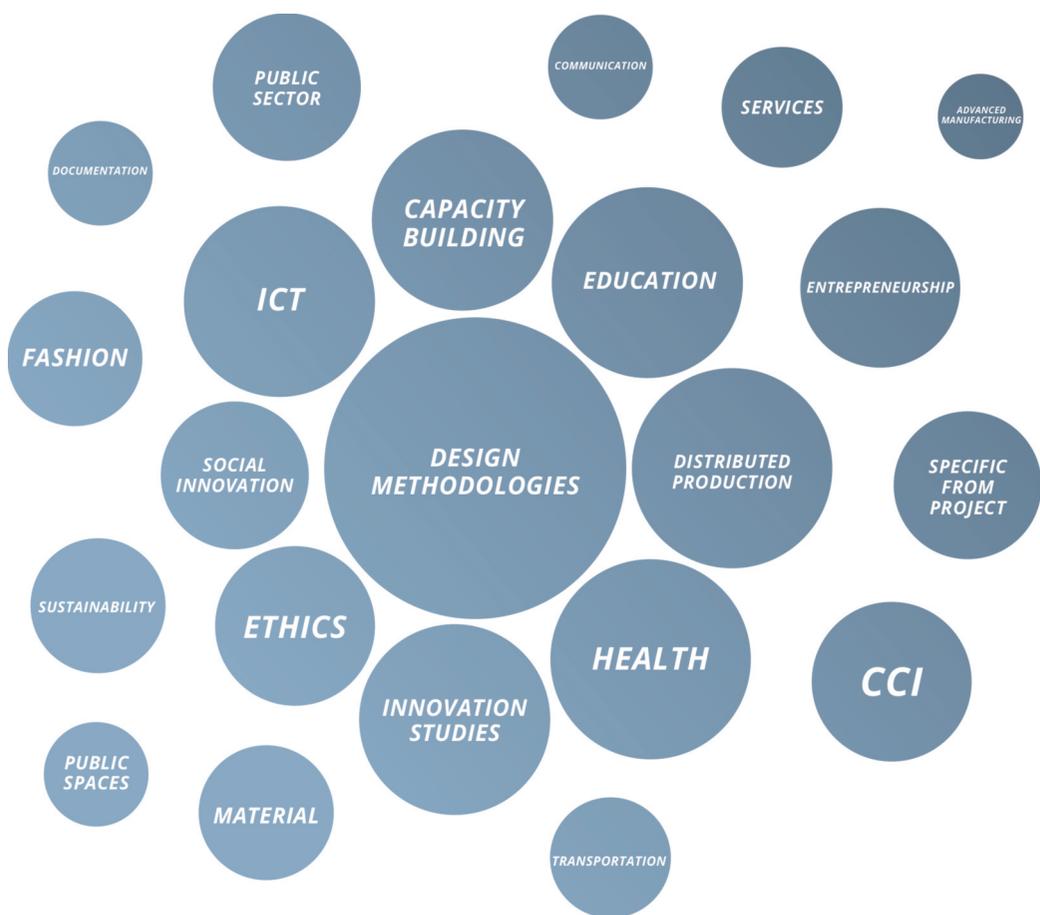


# SEVEN YEARS OF DESIGN RESEARCH AT POLITECNICO DI MILANO

Analysis of the funded research projects

edited by Francesca Rizzo



***Direction: Silvia Piardi***

***Scientific Board:***

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## 2. Context of the analysis and methodology

*Ilaria Mariani, Patrizia Bolzan, Annalinda De Rosa, Venere Ferraro, Marzia Mortati, Xue Pei, Francesca Rizzo, & Davide Spallazzo*  
*Department of Design, Politecnico di Milano*

The book aims at picturing the funded research of the Department of Design of the Politecnico di Milano, building the research landscape explored by its researchers through access to competitive funds (regional, national and EU). For this scope, the study qualitatively analyses the research projects coordinated or participated by principal investigators from the Department of Design, funded and concluded in the timeframe 2014-mid 2021. The ambition is to gain insights into the topics addressed, the dimension of such strands of investigation, and the relationship with the Department's basic research, capturing the results achieved in the short, medium, and long term. Ultimately, the intent is to also reason on upcoming directions of design research.

The methodology applied to return such a picture that reads the multi-level features of the Department's funded research relies on the construction of a knowledge basis composed of project descriptions with the same structure to grant a robust and reliable comparison among them.

The methodology has three phases:

1. Project sample definition
2. Knowledge base development
3. Data extraction and interpretation

The study initiated in June 2021 and ended in September 2022, and its methodology is depicted in fig. 2.1 and detailed below.

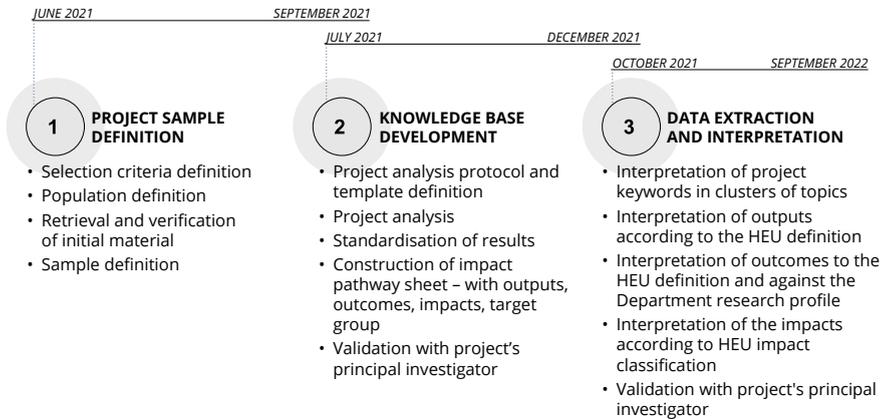


Fig. 2.1 – The phases and steps of the research process of the study.

## 2.1 Phase 1: Project sample definition

The first phase of the study concerns the sample definition. It started in June 2021 and ended in September 2021. The activity began setting the selection criteria, followed by the definition of the study population, the retrieval and the verification of relevant material for the qualitative analysis, which determined the final sample definition.

**Selection criteria definition.** This study uses a holistic model with research projects as single units of analysis. The criteria of selection are identified according to the scope of the study and the need to build a qualitative knowledge base. They are:

- **Timeframe.** The analysis only captured projects funded and concluded in a specified timeframe: from 2014 to mid-2021, when the study started. The snapshot, therefore, does not capture projects completed from the second half of 2021 and beyond or still in progress.
- **Typology.** Coordinated and participated in European and national competitive research projects, coordinated regional competitive research projects, and funded research projects identified to grant a diversity of topics.

**Population definition.** A total of 96 research projects answered the selected time frame (85 competitive funded research projects as in Fig. 1.1, plus 11 funded research projects selected to grant a diversity of topics), of which 45 also answered the typology selection criteria, constituting the study population.

**Retrieval and verification of initial material.** Given the nature and scope of the study, evidence for the analysis is collected through multiple sources and then triangulated (Rothbauer, 2008). In particular:

1. Documents. The collection consists of data and material from principal investigators, such as the description of action, the proposal submitted, the technical/final report of the project. Additional data is collected from scientific publications of the project and dissemination material.
2. Archival records. Additional available resources are collected through other sources, such as project websites and documents uploaded on EU platforms.
3. Open-ended interviews. Conversations with the Department's principal investigators of the projects provided further first-hand material.
4. Artefacts. Ultimately, material and data derived from eventual artefacts produced by the research projects.

The aim is to gain an extensive understanding of the projects analysed. Therefore, several projects were excluded due to two preconditions to the development of in-depth analysis:

- Availability of material. Availability of sufficient and relevant data and documentation, such as project documents and reports, to build a qualitative analysis.
- Availability of principal investigators. The analysis requires continuous discussion with the principal investigators, primarily to participate in interviews to gain first-hand knowledge, and ultimately to validate the analysis developed.

**Sample definition.** The previous steps cut the overall population to 32 projects. The sample is composed of 19 European, 1 national, and 12 regional, as detailed in tab. 2.1.

## 2.2 Phase 2: Knowledge base development

The second phase took place from July 2021 to December 2021, and regards the development of the knowledge base. The phase begins identifying the analysis model as a standardised tool to build an analysis template that frames the evidence and data in a structured manner, allowing to identify relationships between future trajectories of European research and the projects implemented so far.

Tab. 2.1 – The study sample.

Scale	Program	Project name	Year	POLIMI Role	Case ID
EU	Connecting Europe Facility	C-ROADS Italy	2017	Partner	14
	Creative Europe	DDMP	2018	Partner	19
		Human Cities	2014	Partner	22
	Cultura	DigiMooD	2018	Coordinator	03
		MaDe	2018	Partner	11
	Easme-Cosme	DEFINE	2018	Coordinator	07
		Edu4FT	2017	Partner	08
	Erasmus+	FashionSEEDS	2018	Partner	09
		LeNSin	2015	Coordinator	10
		PUDCAD	2017	Partner	18
	Home Affairs	FIRE	2014	Partner	25
		BRIEFING	2018	Partner	06
		CIMULACT	2015	Partner	26
	Horizon 2020	CREA	2015	Coordinator	04
		DiDIY	2015	Partner	31
		NESTORE	2017	Coordinator	15
		SDIN	2015	Partner	29
		SISCODE	2018	Coordinator	30
	Interreg	CO-CREATE	2016	Partner	05
	NAZ	Eranet-Safera	POD	2015	Coordinator
REG	Accordo di Collaborazione	Eupolis	2017	Partner	27
	Bando Ora! 2018 / Fondazione San Paolo	Tango-Down Athena	2018	Coordinator	24
		Enea	LDI	2014	Partner
	Fondazione Cariplo	Cascina 9	2018	Coordinator	23
		Includi.MI	2017	Coordinator	28
		WeMi	2015	Partner	32
	Polisocial	CampUS	2014	Coordinator	21
		TAMBALI FII	2017	Coordinator	20
	Progetti di ricerca applicata per la valorizzazione del patrimonio culturale lombardo	L'architettura in Lombardia dal 1945 ad oggi	2014	Coordinator	01
		Regione Lombardia	DesFromIdeasToMarket	2015	Partner
DIGIKNIT			2017	Partner	02
	NUVOLE	2017	Partner	13	

To capture the non-linear causal relationship that links research activities and impacts, this study relies on a **conceptual model** that derives from the notion of *impact pathways* or *pathways to impact* (Bruno & Kadunc, 2019, p. 66). First introduced for the research quality assessment in the British context, the concept is currently adopted by the Horizon Europe (HEu)

framework, where it is associated with a *Key Impact Pathway Indicators* approach. As it emerges from the HEu programme, the research and innovation funding strategy of the European Commission is soundly built on the impact pathways concept, which is defined as the “Logical steps towards the achievement of the expected impacts of the project over time, in particular beyond the duration of a project. A pathway begins with the projects’ results, to their dissemination, exploitation and communication, contributing to the expected outcomes in the work programme topic, and ultimately to the wider scientific, economic and societal impacts of the work programme destination” (Horizon Europe Programme. Standard Application Form (HE RIA, IA), 2022, p. 29).

Building on this, the study pivots around four elements: (1) *outputs* as the direct result of an implementation action, (2) *outcomes* as short and medium-term effects related to the use and/or exploitation of a project output, and (3) *impacts* as long-term effects on society, the economy and science. Such results are then described through (4) *impact pathways*, which link outputs, outcomes and impacts in a causal sequence of activities, giving a comprehensive picture of the change processes caused by research initiatives (Bruno & Kadunc, 2019) (fig. 2.2).

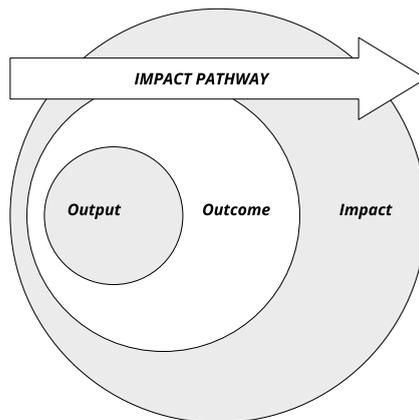


Fig. 2.2 – The impact pathway as the causal sequence of outputs, outcomes and impacts.

On the basis of the impact pathway model, the projects serve as a knowledge base to extract qualitative evidence regarding direct results, effects achieved in the short term, scilicet during the project period, and impact trajectories as long-term effects. The phase unfolds from the design of the

project analysis protocol and its template to its filling, the normalisation of the results, and the elaboration of the impact pathways as a causal sequence of project outputs, outcomes, and impacts.

### **Project analysis protocol and template definition.**

The step starts with the definition of the analysis protocol with the relevant dimensions to consider while observing all the projects, considering the need to build a replicable model to analyse the entire sample. The analysis protocol includes general information about the project, embeds the concept of impact pathway adopted by the HEu programme, and looks into connections to current strategic directions. The protocol is structured in three sections, as shown in the schema (tab. 2.2, column Analysis protocol).

The protocol is then turned into a device, the template, for analysing the sample of research projects and collecting data. Aiming at collecting comparable data, the dimensions identified by the protocol are turned into a set of questions to be addressed during the project analysis (tab. 2.2, column Template). These questions serve as a framework during the desk research as well as during the verbal interviews with the Department's principal investigators (after proper translation for maximising understandability in the framework of a conversation).

**Project analysis.** The template is applied to each project to extract information on the different dimensions identified by the analysis protocol. Data is gathered (i) analysing the project description of action, application, deliverables, technical report, and websites relevant to the project, and (ii) interviewing the principal investigators – even multiple times if needed. Once compiled, the analysis is sent to the project's principal investigator for review and validation.

**Standardisation of results.** The standardisation consists of uniforming and codifying the data collected by the team involved in the study, especially regarding jargon, linguistic style, and detail level of the analysis. The step grants coherence in the analysis in terms of higher uniformity and comparison. The aim is to gain an extensive understanding of the projects analysed.

**Construction of impact pathway sheet.** The construction of the impact pathway sheet is aimed at grasping the project's impact pathway. The sheet is jointly reasoning on the three dimensions of the impact pathway – as previously described in this chapter – and the key elements of the Impact Section as they are identified in the Horizon Europe Programme Standard

Application Form (Horizon Europe Programme. Standard Application Form (HE RIA, IA), 2022, pp. 37-38). The form identifies six relevant dimensions: (i) specific needs, (ii) expected results, (iii) dissemination, exploitation and

Tab. 2.2 – Analysis protocol and template.

	<i>Analysis protocol</i>	<i>Template</i>
<b>Section</b>	<b>Dimension</b>	<b>Description</b>
<b>Section1: Project information</b>	Title	Title
	Duration	Duration
	Program & specific program	Program & specific program
	Links	Links
	5 keywords	5 keywords
	Consortium	Consortium
	Abstract	Abstract as a synthesis from the DoA/ application/website or a mix of these to provide the best synthesis for our purpose
<b>Section 2: Scope and results</b>	Strategic objectives: • issues/challenges and disciplinary areas	Strategic objectives: • Which are the identified issues/challenges and the disciplinary areas in which the research project is situated?
	• key idea and scope	• What is the key idea and scope of the project?
	Department's expertise • Principal activities, role in the contributions	Focus on the Department's expertise: • Provide a brief description of the principal activities in which the Department has led and/ or was involved in, specifying the role it played in terms of tasks and specific contributions
	• Link activities and outputs	• Link the activities with the outputs developed
	• Complementarity or synergy of expertises	• Are the Department expertises complementary or in synergy with those of the other partners?
Impact • Project outcomes and impacts	Impact • What were/are the outcomes and impacts of the activities in which the Department was involved?	
• Impact within the research group: opportunities and inputs	• Which is the impact within the research group able to produce future research and amplify knowledge? Did the project open up opportunities and inputs in other/forthcoming projects?	
• Impact on future research	• How did it impact the research of the group involved in the project or/and the Department? Did it nurture new or further know-how/ reflections/areas of investigation?	

(continued)

	<i>Analysis protocol</i>	<i>Template</i>
Section	Dimension	Description
Section 3: Strategic contribution	Contribution to knowledge	Which is the main contribution to knowledge brought?
	Link with HEU, Missions, PNRR as strategic documents	Possible emergencies and common trajectories to the three relevant strategic documents (HEU, Missions, PNRR)
	Expertise not fully exploited	Are there areas in which the Department could/ should bring expertise but are not yet/fully exploited or recognized as its strengths?
	Contribution to the Department research lines	Did this project contribute to the Department's research line(s)?

communication measures, (iv) target group, (v) outcomes, (vi) impacts. Beyond the dimensions already included in the analysis template, the inclusion of the target group is considered relevant, since it zeroes in on who will benefit from the project's results and who will use or further up-take them. The resulting template consists of a further synthesis device aimed at extracting and causally linking the project outputs, outcomes, and impacts, together with the target group of the project. The information collected in the analysis template is revised including the fourth dimension of the target group, derived from the key elements of the impact section of the HE proposal format. The result is a sheet gathering data on (i) output, (ii) outcome, (iii) impact, (iv) target (fig. 2.3). To fill the impact summary sheet template a second round of data extraction from the given documents is necessary, often also requiring further interviews with the project's principal investigator.

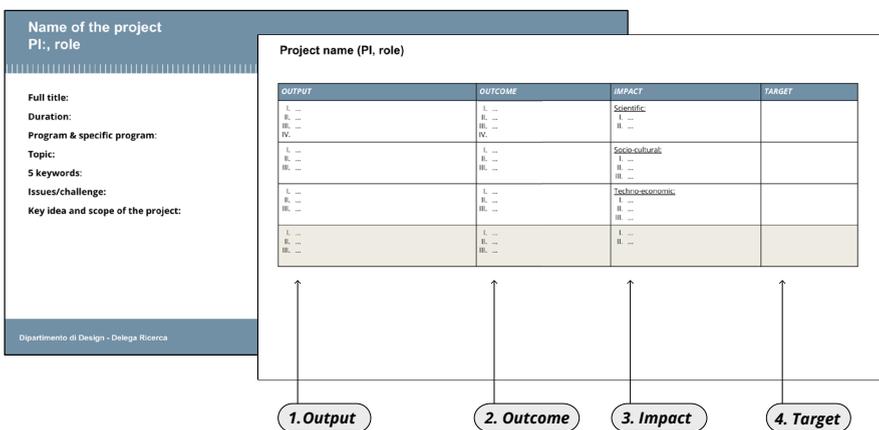


Fig. 2.3 – The impact pathway sheet.

**Validation with project’s principal investigator.** The new round of data compilation is followed by a further review and validation of the pathways to impact with the project’s principal investigator.

## **2.3 Phase 3: Data extraction and interpretation**

Finally, the third phase of the methodological approach, running from October 2021 to September 2022, focused on interpreting the projects through the three dimensions of the impact pathway: outputs, outcomes, and impacts. Each dataset is characterised by a specific procedure to address the interpretation, being the object of a specific analysis. Although their detailed description is presented respectively in the chapters 3, 4, 5, and 6 of this book, in the following it is briefly described their development.

**Interpretation of project keywords in clusters of topics.** The analysis elaborates and clusters the 159 keywords used to describe the research projects in the 32 project analyses, gaining a comprehensive picture of the topics addressed by the funded research project of the Department. Following an iterative process of refinement and polishing, the dataset of 159 keywords is analysed to build thematic clusters through a bottom-up approach. 22 clusters identifying common trends and macro-topics are mapped: 21 thematic clusters plus “Specific from project”. These keywords and topics are then interpreted against the 113 keywords and topics elaborated in 2015 on the delivery of the new Department website and describing its research. On this occasion, a bottom-up process was launched, and each researcher of the Department contributed with their keywords. After validation, the process produced 113 keywords as a sort of self-portrait of the Department’s basic research. By identifying continuity, discontinuity, and differences between the set of keywords, the analysis provides a landscape of the Department’s competitive research, providing evidence on how funded research subjects affect fundamental design research. The analysis unfolds from the elaboration and clustering of keywords describing the 32 research projects, obtaining a comprehensive overview of the themes covered. Clusters of topics stemming from funded research have then been confronted with the keywords used to describe the Department research profile and the basic research themes.

**Interpretation of project outputs according to the HEU definition.** In this step, all the outputs presented in the 32 impact pathway sheets are extracted. The original list of outputs, worded as reported in the proposal and

validated by the principal investigator, is standardised. The result is a list of 54 outputs. Different clustering methodologies coming from relevant frameworks and programmes are applied to interpret the outcomes. However, they were discarded since they could not fit the depth and extension of the objects analysed. As a result, the list of outputs collected from the study is interpreted through a two-level operation: firstly, a bottom-up operation identifies output clusters; secondly, a top-down operation revises and identifies the final clusters through a qualitative validation phase. The bottom-up clustering identifies 6 output clusters: Analytic, Educational, Instrumental, Performative, Scientific, and Tangible. Outputs are then attributed to these categories.

**Interpretation of project outcomes to the HEU definition and against the Department research profile.** The outcomes described in the 32 impact pathway sheets are extracted and interpreted against two relevant grids of analysis: 113 keywords of the Department of Design, organised under 3 typologies; and a selection of 45 ERC keywords representative of the Department research. Both these lists are a portrait of the Department's research activity, produced through bottom-up approaches that saw the researcher of the Department actively contributing respectively to their definition and identification among the overall set of ERC keywords. The list of outcomes depicted in the impact pathway sheets is then interpreted and mapped against these two lists of keywords, with the Department Keywords providing an inside perspective, and ERC Keywords relevant to the Department providing an outside perspective.

**Interpretation of the impacts according to HEU impact classification.** The projects' impacts, as depicted in the 32 impact pathway sheets, are extracted and standardised to maximise formal coherence. For the purpose of interpretation, the list of impacts is analysed according to the study methodology, namely the framework proposed by the European Commission to monitor and measure the impact of research and innovation projects. Therefore, the list of impacts is interpreted against the 3 impact categories of scientific, social, and economic/technological impacts, and the 9 Key Impact Pathways of the Horizon Europe Program (European Commission, Directorate-General for Research and Innovation, 2022).

**Validation with project's principal investigator.** The interpretation is validated and iterated through direct interviews with the project's principal investigator.

To conclude the methodology, it is fundamental to point out that the development of the Impact Pathways took place *ex-post* and, despite validation with the project's principal investigators, carries with it an important element of interpretation due to the researcher running the study.

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# Authors

**Francesca Rizzo (editor)**, Ph.D. in Electronics and Telecommunications Engineering, is Professor at Politecnico di Milano, Department of Design where she serves as delegate of Director for the research activity. She is expert in Participatory Design (PD) applied to the fields of service design, social innovation, and public sector innovation. She has been actively working as researcher for various EU projects in the FP7 programme and in H2020 (Peripheria, My Neighborhood, Smart Campus, Life 2.0, SIC, SISCODE, easyRights, NetZeroCities). She will serve as coordinator of ORBIS under HEurope (2023-2026). She is author of many publications in journals and conference.

**Patrizia Bolzan**, Ph.D. in Design, is Researcher at the Department of Design of Politecnico di Milano. She investigates the ratio between digital fabrication, with particular attention on additive manufacturing technologies, and Design in practices and processes. She deals with circularity in product system design and technological integration in prototypes. She has participated in several research projects, and she is the coordinator of De-Forma (Design Explorations on Biofabricated Organic Materials) project, funded by the Department of Design, with the basic research grant. Since 2015 she has been on the permanent staff of Polifactory, interdepartmental makerspace and FabLab).

**Alessandro Deserti** is Professor in Design at the Politecnico di Milano, where he is currently leading the Department of Design. His main research lines deal with design-enabled innovation processes, methods and tools and ways in which they combine with systemic and organization change. He investigated the application of design methods and tools in diverse contexts, such as human smart cities, social innovation, responsible research, and in-

novation (RRI), public sector innovation (PSI), business model innovation. He has been actively working as researcher for various EU projects in the FP7 and in H2020. He is currently involved in DESIRE a HEurope project demonstrator for the New European Bauhaus initiative. He is author of many publications in journals and conference.

**Annalinda De Rosa** is Post-doc Research Fellow at the Department of Design of Politecnico di Milano; adjunct professor at the School of Design, and the MSc Innovation and Technology Management of Università Cattolica del Sacro Cuore. Her research concerns the relationship between spatial and service design, specifically focusing on design-driven models for incubating innovative processes for the CCS to improve social cohesion through participatory design in urban and rural areas. Member of the Polimi DESIS Lab within the international DESIS Network (Design for Social Innovation and Sustainability). She is the project manager of Human Cities/Smoties – Creative works with small and remote places research project (Creative Europe program).

**Venere Ferraro**, Ph.D. in Design, is an Associate Professor at the Department of Design of the Politecnico di Milano. She participated in several International and National research; she has been the coordinator of the research project “POD” (SAFERA 2014 joint call) and the European research project “DATEMATS” (KA2-2018). What characterizes her research is human-centred design. The research interests lie in the domain of interaction design, more in detail: the role of wearable technologies, emerging materials, and big data in designing experiential systems for digital care, with particular attention to tools and methods for changing user behaviour.

**Ilaria Mariani**, Ph.D. in Design, is Researcher at Politecnico di Milano, Department of Design, where she is part of the team supporting the research activity. Her research interests are at the intersection of interaction, communication, and service design. Her research addresses games and complex interactive systems for communication and speculation, social change and innovation, focusing on comprehending their impact on users. In recent years she moved her focus to digital transformation and design-led innovation in the public sector. She actively participates in various research projects on these topics, such as the H2020 SISCODE and easyRights, the CEF AI4GOV, the ESPON Digiser, and the HEU ORBIS.

**Marzia Mortati**, Ph.D., is Associate Professor in Service Design at the Department of Design of Politecnico di Milano. She is Vice-Director of the

International Master in AI for Public Services and one of the executive directors of the European Academy of Design. Her research focuses on the design process, service design, public sector innovation, and new technologies. She has worked on numerous international research projects and has authored several articles in international scientific journals (i.e., Design Issues, Technovation, Design Management Review, The Design Journal, Policy Science, International Journal of Entrepreneurial Research and Behaviour) and conferences since 2008.

**Xue Pei** is a Post-doc Research Fellow at the Department of Design of Politecnico di Milano, where she obtained her Ph.D. in design management. Her research and design practices focus on applying design (thinking) approach, methods, and tools to foster innovation in organisations in both private and non-profit sectors. She has developed expertise in design research, strategic scenario building, and service system design. She has participated in a number of European and national research projects (Horizon 2020, Interreg, Fondazione Cariplo), and co-led several strategic and service design research projects with private funding. She also conducts didactic activities in public universities and private institutions.

**Davide Spallazzo** has a Ph.D. in Design and is an Associate professor at the Department of Design of Politecnico di Milano. His research sets in the interaction design field, particularly in UX, aesthetics, and meaning-making. He has been coordinating research projects in the field of cultural heritage and serious gaming. In recent years he moved his attention to the intersection of AI and Design, coordinating the Meet-AI research project aimed at eliciting the design qualities of AI-infused products and defining a new UX assessment method. He is currently serving as deputy coordinator of the Ph.D. program in Design and as secretary of the MSc in Digital & Interaction Design at Politecnico di Milano.

Which are the main research funds currently accessed by the Department of Design? What are the topics explored through them and which are the interconnections with the Department core research activities? Also, what are the research products delivered, the reached outcomes, and the expected impacts BY these research projects?

The book synthesises the results of a qualitative analysis conducted over 32 research (out of 96) projects coordinated or participated in by the researchers of the Department in the timeframe 2014-mid 2021.

The results of the analysis confirm the high-level attractiveness of the Department research profile on core topics such as design methodology, service design, and health.

However, more interestingly, the analysis shows a significant variety of new topics and themes that emerge as new research questions for the Department, such as the role of design in public sector innovation, ethics, or policy design.

The publication provides a snapshot of the topics addressed through the competitive research projects, the dimension of such strands of investigations, the typology and features of results achieved, as well as their relationship to the Department's basic research lines.

The relationship and interplay among the outputs, outcomes, and impacts of the funded research is then elaborated in impact pathways, opening up reflections about the upcoming and future of Design research. The findings of the analysis aim to capture the present to understand future directions in terms of scientific, societal, technological and economic aspects.

The volume addresses an academic audience from long terms researchers the field of design and other closely related scientific-disciplinary fields at the national and international levels, to young researchers approaching the world of design research.