

PROCEEDINGS

**Verso un programma nazionale per la Simbiosi Industriale:
prospettive e opportunità per l'Italia**

**Towards a national industrial symbiosis programme:
prospects and opportunities for Italy**

**Symbiosis Users Network – SUN
Proceedings of the seventh SUN Conference**

November 8th 2023

Edited by Tiziana Beltrani and Marco La Monica





ITALIAN NATIONAL AGENCY FOR
NEW TECHNOLOGIES, ENERGY AND
SUSTAINABLE ECONOMIC DEVELOPMENT



Verso un programma nazionale per la Simbiosi Industriale: prospettive e opportunità per l'Italia

Towards a national industrial symbiosis programme: prospects and opportunities for Italy

Symbiosis Users Network – SUN

Proceedings of the seventh SUN Conference

November 8th 2023

Edited by

Tiziana Beltrani and Marco La Monica

Towards a national industrial symbiosis initiative: prospects and opportunities for Italy

Symbiosis Users Network – SUN

Proceedings of the seventh SUN Conference

November 8th, 2023

Edited by Tiziana Beltrani and Marco La Monica

2024 ENEA

National Agency for New Technologies, Energy and
Sustainable Economic Development

978-88-8286-478-1

Cover design: Flavio Miglietta

Introduzione	5
Introduction	8
INTERVENTI AD INVITO	11
<i>Contributo di Silvia Grandi – Ministero dell’Ambiente e della Sicurezza Energetica</i>	<i>12</i>
<i>Contributo di Carlo La Rotonda – RetImpresa.....</i>	<i>18</i>
<i>Contributo di Antonio Visconti - FICEI.....</i>	<i>23</i>
<i>Contributo di Piero Manzoni – Simbiosi.....</i>	<i>26</i>
<i>Contributo di Sergio Barel – Consorzio di sviluppo economico locale Ponterosso Tagliamento</i>	<i>31</i>
<i>Contributo di Marco Battaglia - Sfridoo</i>	<i>34</i>
<i>Contributo di Camilla Colucci - Circularity.....</i>	<i>36</i>
<i>Contributo di Claudio D. Brugnoli - Centrocot.....</i>	<i>38</i>
INTERVENTI DA CALL FOR PAPER.....	42
<i>Advanced design for circularity and sustainability: digital solutions to foster the transition of made in Italy.....</i>	<i>43</i>
<i>Wastudy: The Italian observatory of the special waste market.....</i>	<i>50</i>
<i>Textile industry towards circularity: the role of the extended producer responsibility</i>	<i>55</i>
<i>Life cycle assessment in multinational companies: analysis of guidelines for the packaging sector </i>	<i>62</i>
<i>Recovery and valorization of polyurethane mattresses at the end of their lifecycle: a concrete demonstration of circular economy and industrial symbiosis.....</i>	<i>69</i>
<i>A circular economy survey in sicilian agri-food sector.....</i>	<i>77</i>
<i>Industrial symbiosis in the Marche region. The preliminary results of the Marlic project.....</i>	<i>84</i>
<i>Innovative sensors to detect the ripening stage of tomato fruits for efficient crops control in smart greenhouses</i>	<i>89</i>
<i>ETV as a supporting tool for the achievement of specific goals of the Italian national strategy for the circular economy on the issue of industrial symbiosis</i>	<i>95</i>
<i>Planning industrial districts development through the is-based waste-wastewater-energy nexus </i>	<i>101</i>
<i>Water, waste and energy: prospects and opportunities.....</i>	<i>109</i>



Ecomondo 2023, Rimini – Un momento del convegno SUN, 8 novembre 2023



ITALIAN NATIONAL AGENCY FOR
NEW TECHNOLOGIES, ENERGY AND
SUSTAINABLE ECONOMIC DEVELOPMENT



INTERVENTI DA CALL FOR PAPER

Advanced design for circularity and sustainability: digital solutions to foster the transition of made in Italy

Erik Ciravegna^{1*}, Flaviano Celaschi¹, Michele Zannoni¹, Laura Succini¹,
Veronica Pasini¹, Clara Giardina¹, Davide Pletto¹

¹ *Department of Architecture, Alma Mater Studiorum – Università di Bologna, ITALY.*

(E-mail: erik.ciravegna@unibo.it)

*Corresponding author

Abstract

In recent years, numerous reflections have emerged on how design practices offer possible solutions to respond to the ecological transition. In this context, Advanced Design, considered as an anticipatory and multidimensional design approach, intersects with Transition Design, which focuses on the theory of change and the study of possible futures, to come up with a new profile of “Transitional Industrial Designer”, capable of incorporating the practices of mediation and anticipation in the sustainable and circular transition of industrial processes. This reflection currently finds a space for practical experimentation and theoretical exchange within an NRP-funded research program (MICS) and specifically in projects under one of its lines of intervention (Spoke 1), with the aim of creating new design models that consider the diversity of disciplinary approaches, the complexity of production chains and the heterogeneity of the actors involved, in order to arrive at affirming a principle of “Design Endless Responsibility”, where digital tools are agents of mediation and interaction.

Keywords: Advanced Design; Ecological Transition; Transitional Industrial Design; Digital Solutions; Made in Italy.

Towards the definition of a transitional industrial designer

In recent years, numerous theoretical reflections have emerged on how design practices and approaches offer different perspectives and possible solutions to respond to current crises [1], with the aim of supporting change and transition towards more responsible and sustainable forms of innovation, capable of taking into account both the environment and the different actors in it [2, 3]. In this context, Advanced Design, within the framework of Process Design, is a systemic, anticipatory, multidisciplinary and multidimensional approach, based on collaborative practices capable of driving transformative change within the realities in which it operates.

Advanced Design explores and investigates the role of design cultures in academic, business, institutional and social contexts to innovate not only products and services but also socio-technical systems [4, 5]. It intervenes within value chain enhancement and

transformation processes, connecting multiple actors and disciplines, and promotes collaboration, collective intelligence and adaptivity as key factors to support new forms of knowledge [6] and more sustainable production and consumption patterns that reduce social, environmental and economic impacts. In this perspective, the designer assumes a role as a mediator of knowledge [7] and needs of different stakeholders [8, 9], becoming a protagonist of these changes. Advanced Design also puts the concept of anticipation and future studies at the centre of its work [10, 11, 12] as drivers supporting an 'advanced design approach' capable of responding to the complexity of changing contexts [13, 4] conditioned by environmental, social and resource constraints, in line with the Sustainable Development Goals (SDGs) of the UN 2030 Agenda and with the European Commission's Green Deal to outline transformational policy interventions on energy, climate and circularity. Working in anticipation is a key concept in transition processes. In addition to Advanced Design, Transition Design [14, 15] works at the intersection of the theory of change and the study of possible futures to define appropriate strategies for designing responsible innovation paths, interconnecting technological and economic systems with socio-cultural and natural systems. This approach focuses, in fact, on ecological and social transition [16, 17] and is inspired by the Transition Town movement, initiated by Rob Hopkins [18], which starts from community projects to go and solve local and global problems. Transition Design aims to address the wicked problems of the 21st century such as climate change, loss of biodiversity, depletion of natural resources and the growing gap between rich and poor to support the design-led transition of society towards more sustainable futures [15]. The long-term goal is a design of and for radically new paradigms that challenge the status quo and are based on equity and quality of life [19].

From the intersection of these two approaches, new ways of designing and a new profile of designer emerge, which can be referred to as the “Transitional Industrial Designer”, capable of bringing practices of mediation and anticipation into the sustainable and circular transition of industrial processes, an active agent of change who moves between the micro and macro scales and is able to imagine, starting from past and present situations, possible medium- and long-term futures that can be modified over time through the creation of scenarios.

Digital advanced design for the transition of Made in Italy

The theoretical reflection around the integration of mediation and anticipation in transition processes, as well as around the definition of the Transitional Industrial Designer's profile, was set down from the point of view of practical experimentation within the “MICS - Made in Italy Circolare e Sostenibile” (Circular and Sustainable Made in Italy) research programme, financed by the Italian Ministry of Universities and

Research (MUR) thanks to funds made available by the European Union under the NextGenerationEU programme and representing one of the projects relating to Mission 4 (Education and Research) of the PNRR. MICS is carried out by an Extended Partnership composed of 25 partners, of which 12 of them are public (including universities and research centers) and 13 industrial, engaged in multiple joint basic and industrial research activities, with the aim of promoting circularity and sustainability in the design and production of Made in Italy, within three of the sectors that most characterize the Italian industrial scenario: Fashion, Furniture and Automation. MICS involves the development of about 80 projects geared toward responding to current challenges affecting current design, production and consumption patterns, as well as end-of-life management of products, to facilitate the processes necessary for the ecological transition of Made in Italy.

In order to achieve its objectives, MICS has defined eight research areas, called Spokes, which are oriented towards specific lines of intervention, transversal to industrial sectors, and characterizing the current challenges of Italian manufacturing: from the ecological transition to overcoming the energy crisis, from recovering waste materials within production processes to move towards more circular models to improving relations between the players in the various supply chains, to name but a few examples. Among these eight MICS research areas, Spoke 1, which involves 13 MICS partners and is coordinated by the University of Bologna, is dedicated to the topic “Digital Advanced Design: Technologies, Processes, and Tools” and aims at investigating digital solutions (innovative technologies methods and tools) to foster circular and sustainable innovation processes, expanding the capabilities of industrial designers – the above mentioned “Transitional Advanced Designers” – along the entire production process, according to a systemic model focused on continuous dialogue with the multiple actors involved in the process (the so-called “Open Innovation” approach).

Material elements such as advanced manufacturing, innovative materials, circular processes and systems for measuring impacts (of an environmental, social and economic nature), are placed at the centre of the Spoke 1 line of intervention, which are combined with intangible elements such as gender equity, citizenship involvement, ethics, etc., and human factors such as ergonomics and bio-psycho-social well-being, according to a “Responsible Advanced Design” approach [20, 21]. Circularity and sustainability are in fact not only prerogatives of the scientific-technological sphere, but also of the social-humanistic one. In this dialectical relationship, Advanced Design fits in as a mediator of knowledge and skills and activator of multi-stakeholder collaborative practices. The aim of Spoke 1 is therefore to create new design models that take into account the variety of disciplinary approaches, the complexity of the production chains and the heterogeneity of the actors involved, in order to affirm a principle of “Design Endless

Responsibility” (DER), according to which the designer is called upon not only to connect areas and actors (mediation), but also to take into account the entire value chain and its future impacts (anticipation), putting into play knowledge and practices that allow for responsible solutions.

In this scenario, digitization becomes the guiding thread of research activities: design-enabled enabling technologies facilitate and monitor information flows, tracking and anticipating the consequences of design choices made. Digital tools are not merely a medium, but agents of mediation and interaction. In this sense, among the expected results of the Spoke 1 research activity is the creation of a portfolio of advanced digital solutions at the service of the Transitional Industrial Designer.

Digital solutions to improve packaging as a platform for collaboration and exchange

Among the projects developed within Spoke 1, some of them are oriented toward knowledge-sharing processes and specifically the role of design as a mediator between the actors involved within different supply chains, including with a view to industrial symbiosis. One of the projects going in this direction, involving Università di Bologna (project leader), Politecnico di Torino and Università di Firenze, is dedicated to the theme “FuturE-Pack. Digital Advanced Design for the Enhancement of Packaging as a ‘Broadcaster’ in the Made in Italy Supply Chain”.

The project goal is to explore the application of digital solutions to packaging to enhance its significant role as a communication channel for information exchange [22, 23]. In particular, the role of packaging in recording, storing, translating, and communicating relevant information about packaged products and their impacts throughout the supply chain is investigated in order to: on the one hand, facilitate information sharing among supply chain actors to facilitate the safe and efficient movement of goods; and promote the emergence of “green logistics”; on the other hand, improve the end-user experience through transparent, understandable, accessible, and inclusive information to encourage more informed and sustainable purchasing and consumption choices.

FuturE-Pack is thus exploring the potential of so-called “Advanced Design” and pushed digitization to improve the role of packaging as a “communication device,” as a digital platform that facilitates the monitoring and traceability of packaged goods and their impacts throughout their lifecycle, and the exchange of information both among supply chain actors and between them and end users. The study focuses, as an application case, on the E-Commerce sector of the Fashion System, but the goal is then to test it in other strategic sectors of Made in Italy.

Conclusions

From the intersection of Advanced Design with Transition Design it is possible to define new ways of designing. A new figure emerges, the Transitional Industrial Designer, capable of lowering practices of mediation and anticipation into the transition of industrial processes towards sustainability and circularity. Such a figure integrates advanced and systemic skills, enabling design and production processes to be managed more quickly and flexibly, responding more appropriately to contemporary challenges and adapting more easily to changing social, environmental and economic contexts. Taking into account the contextual variables of complexity and uncertainty, the Transitional Industrial Designer considers in an integrated way all the material and immaterial elements involved in the project and manages, in collaboration with stakeholders and experts, the entire design process, including the redefinition of relationship patterns, as well as those of production and consumption [24, 25]. The theoretical reflection around the integration of mediation and anticipation in transition processes, as well as around the construction of the figure of Transitional Industrial Designer, has been dropped in different contexts to those of MICS for example in training and third mission activities related to the world of research and will also be tested in international cooperation contexts, despite that Spoke 1, remains the 'privileged area of observation. In fact, thanks to its territorially widespread structure and the variety of actors involved, it allows the exploration on several dimensions of different application areas for the principle of the so-called DER, according to which the planner operates both at the level of mediation between disciplines, actors and skills and at the level of anticipation of impacts. In addition, the organization of MICS and the configuration of Spoke 1, and its lines of work, mark an important milestone with respect to the recognition of the role, within production processes, of design theories and practices, which are officially accorded a central role in solving complex problems, in the transition to circularity and sustainability.

Acknowledgment

This study was carried out within the MICS (Made in Italy – Circular and Sustainable) Extended Partnership and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.3 – D.D. 1551.11-10-2022, PE00000004). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.

References

1. Bauman, Z., & Bondoni, C. (2014). *State of Crisis*. John Wiley & Sons.

2. Carayannis, E.G., Barth, T.D. & Campbell, D.F. The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. *J Innov Entrep* 1, 2 (2012). <https://doi.org/10.1186/2192-5372-1-2>
3. Succini, L., & Ciravegna, E. (2022). Design and Responsible Innovation. Ethics and Caring as Keys to Addressing Contemporary Crises. *diid — Disegno Industriale Industrial Design*, (77), 14, 24-36. <https://doi.org/10.30682/diid7722b>
4. Celaschi, F. (2015). Advanced Design Points of View. In M. Celi (Ed.), *Advanced Design Cultures* (pp. 3-17). Springer. https://doi.org/10.1007/978-3-319-08602-6_1
5. Succini, L. (2023). Leggere l'Innovazione Responsabile attraverso l'Advanced Design. In E. Formia, V. Gianfrate, & L. Succini (Eds.), *Design per l'Innovazione Responsabile. Guida per processi formativi in trasformazione* (pp.21-36). FrancoAngeli.
6. Celaschi, F. (2008). Il design come mediatore tra bisogni. Il Design come mediatore tra saperi. In C. Germak (Ed.), *L'uomo al centro del progetto* (pp. 40-52). Allemandi.
7. Celaschi, F., Celi, M., & Formia, E. (2014). Quando il design incontra il futuro. When Design Meets Future. *Planning Design Technology. Utopia. Futuro. Past, Present*, 3, 20-29.
8. Celaschi, F., Formia, E., Iñiguez Flores, R., & León Morán, R. (2019). Design Processes and Anticipation. In R. Poli (Ed.), *Handbook of Anticipation*, pp. 773–793. Springer International Publishing. https://doi.org/10.1007/978-3-319-91554-8_48
9. Iñiguez Flores, R., Hernandis Ortuño, B., Holliger, C., & Monterrubio Soto, J.C. (2014). Advanced Design as a Process for Knowledge Creation. Delivering Knowledge to Stakeholders and Fostering Future Skills for Innovation. In F. Celaschi, R. Iñiguez Flores, R. M. León Morán, X. Arias González, & R. Estrada Sainz (Eds.), *The Shapes of the Future as the Front End of Design Driven Innovation – 5th International Forum of Design as a Process* (pp. 151-156). PorruaPrint.
10. Poli, R. (2010). An Introduction to the Ontology of Anticipation. *Futures*, 42(7), 769–776. <https://doi.org/10.1016/j.futures.2010.04.028>
11. Poli, R. (Ed.). (2019). *Handbook of anticipation: Theoretical and applied aspects of the use of future in decision making*. Springer.
12. Zamenopoulos, T., & Alexiou, K. (2007). Towards an Anticipatory View of Design. *Design Studies*, 28(4), 411–436. <https://doi.org/10.1016/j.destud.2007.04.001>
13. Celi, M. (Ed.). (2010). *AdvanceDesign. Visioni, percorsi e strumenti per predisporre all'innovazione continua*. Mc. Graw-Hill.
14. Kossoff, G. (2011). *Holism and the Reconstitution of Everyday Life: A Framework for Transition to a Sustainable Society* [Doctoral Dissertation]. University of Dundee, Scotland.
15. Irwin, T. (2015). Transition Design: A Proposal for a New Area of Design Practice, Study, and Research. *Design and Culture*, 7(2), 229-246. <https://doi.org/10.1080/17547075.2015.1051829>
16. Pereno, A., & Barbero, S. (2020). Systemic design for territorial enhancement: An overview on design tools supporting sociotechnical system innovation. *Strategic Design Research Journal*, 13(2), 113-136. <https://doi.org/10.4013/sdrj.2020.132.02>
17. Celi, M., & Morrison, A. (2019). Anticipation and Design Inquiry. In R. Poli (Ed.), *Handbook of Anticipation: Theoretical and Applied Aspects of the Use of Future in Decision Making* (pp. 795–819). Springer International Publishing.
18. Hopkins, R. (2008). *The transition handbook: From oil dependency to local resilience*. Green Books.

19. Irwin, T., Tonkinwise, C., & Kossoff, G. (2022). Transition design: An educational framework for advancing the study and design of sustainable transitions. *Cuadernos del Centro de Estudios en Diseño y Comunicación. Ensayos*, (105), 31-72.
20. Succini, L., & Ciravegna, E. (2022). Design and Responsible Innovation. Ethics and Caring as Keys to Addressing Contemporary Crises. *Diid — Disegno Industriale Industrial Design*, (77), 24-36. <https://doi.org/10.30682/diid772022b>
21. Ciravegna, E.; Leon Moran, R., & Succini, L. (2023). Sviluppare metodi e processi per una cooperazione adattiva tra locale e globale. In E. Formia, V. Gianfrate, & L. Succini (Eds.), *Design per l'Innovazione Responsabile. Guida per processi formativi in trasformazione* (pp.56-71). FrancoAngeli.
22. Ciravegna, E. (2010). *La qualità del Packaging*. FrancoAngeli.
23. Ciravegna, E. (2020). Repensar los envases en tiempos de crisis: implicancias éticas y enfoque sistémico en el Diseño de Packaging. *RChD: Creación y Pensamiento*, 5(9), 1–6. <https://doi.org/10.5354/0719-837X.2020.59536>
24. Rosato, L. (2023). *Transition Matters. Il ruolo del designer nella transizione sostenibile e circolare dei materiali polimerici* [Doctoral Dissertation]. Alma Mater Studiorum - Università di Bologna, Italy.
25. Giardina, C. (2023). Holistic Approach in Design Research: Made in Italy Circular Packaging Innovation by Transitional Industrial Designers. *Diid — Disegno Industriale Industrial Design*, (79), 20-33. <https://doi.org/10.30682/diid7923b>

Symbiosis Users Network – SUN



www.enea.it

ISBN: 978-88-8286-478-1