DOI: 10.14267/phd.2016007

Corvinus University Budapest

Trento University

Innovation Patterns In The Design-Driven Industries:

Opening Up The Made In Italy

Doctoral Dissertation

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Faludi Julianna

Budapest, 2015

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This dissertation was written in the frame of a co-tutelle agreement of Corvinus University and University of Trento.

DOI: 10.14267/phd.2016007

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Table of Contents

DOI: 10.14267/phd.2016007

DOI: 10.14267/phd.2016007

Index of Figures

Index of Tables

DOI: 10.14267/phd.2016007

Index of Photos

DOI: 10.14267/phd.2016007

Innovation Patterns in the Design-Driven Industries: Opening Up the 'Made In Italy'

Keywords: modularity, innovation, open innovation, collaborative open innovation, organization science, design-driven industries, knowledge-intensive business services

Acknowledgments

I would love to thank my tutors, dr. Zoltán Szántó for the constant encouragement during these long years, dr. Ermanno Tortia for the thorough and insightful comments, and dr. Luca Solari for kindly hosting me in Milan. The theoretical frames and the approach of this research have been inspired by the 14th Trento Summer School on *Modularity and Design for Innovation* lectured in collaboration with the Harvard Business School. I thank my reviewers and opponents of the first submitted version, dr. Attila Melegh, dr. Ermanno Tortia and dr. László Letenyei for their valuable insights and rigorous comments improving the text. Moreover, I thank dr. Anna D'Ambrosio, dr. Bruno Dallago and dr. Joachim Möller for their comments and suggestions at the *Tradition, Innovation and Reform in Local Development* conference in Budapest organized by Corvinus University (11-12 September 2015), and dr. Pauwke Berkers for commenting the final version of the text.

I owe so much to Giannino Malossi for all our fruitful and inspiring discussions, strolling in the streets exploring the hidden and glamorous corners, galleries, cafes and openings of Milan, as well as for Giannino's precious comments, the valuable contacts to fabulous people in the magic

DOI: 10.14267/phd.2016007

world of Italian design and for giving books and articles that reshaped my rigorous academic stance.

I owe my gratitude to all of my interviewees for carving out time in their busy schedules, and dedicating their full attention and availability to this research.

I thank my wonderful family for all their patience and precious support, my husband and wonderful daughter for their love and understanding, and my parents for providing me all I needed to get here.

I owe my gratitude to my friends for raising my spirits in moments of difficulties, or heroically reading and commenting the first messy drafts of my work. I thank everyone, who were there with me.

This research was funded by the Erasmus+ programme of the European Union.

DOI: 10.14267/phd.2016007

Introduction

Intro 1. Scope of the Research

What is This Book About?

I enter allegedly different fields, the production of tangible and intangible products. What combines the two is my approach of deconstructing the semantics and production of these artifacts and bringing it forward to a common platform of organizational behavior demonstrated in innovation patterns. I hope my straight line of argumentation in the realm of modularity/ production/ innovation persuades the reader of the soundness of the findings presented, despite the swirls and roundabouts of discussion with which I explicitly intend to deepen our understanding of the fields discussed and not less to challenge and at some points even entertain the reader by adding dimensions to flat writing. I invite the reader to jump into this book drawing on their scholarly experience, however opening the eye, senses and adding their imagination as the objects of discussion come from a magical field: the entourage of objects and services designed to serve, beautify or ease our everyday needs.

I also open doors for further discussion, which I intend to explore in-depth in further essays illustrating them with abundant examples, however in this current book I am streamlining the argumentation to lead the reader through a lean architecture.

The theoretic framing relies on scholarship of three main strands of institutional economics and organizational science:

- innovation [with a special focus on open innovation]
- theory of the firm [organizational behavior]
- modularity

DOI: 10.14267/phd.2016007

In addition to this skeleton of main three theoretic inputs I draw on further fields to complement the understanding of the notions this study deals with:

- design-driven industries
- technology and management

My approach lies in and is inspired by evolutionary economics framing the above-listed main strands this study relies on. This implies that economic dynamics allow for seeing industry dynamics from a timely perspective, that agents interact in a process of evolution, they learn by accumulating knowledge, and strive for survival by adapting to and being adopted by the environment, moreover they struggle with uncertainty, have a bounded rationality, and do not go for an abstract optimal-solution in decision-making [Alchian 1950, Alchian and Demsetz 1972, Penrose 1952, Schumpeter 1934, Schumpeter 1950, Nelson and Winter 1982, etc].

In the chapters of this book I illustrate, dissect, abstract and suggest a frame where the real focus is not the agents themselves but the dynamics of innovation, where core concepts evolve, processes open up, visual or dramatic elements interact with production forms, and platforms create ecosystems, where innovation flows across players, contexts and disciplines. Searching for the connection between modularity, innovation and openness, this research was designed based on the following assumptions based on previous scholarship (forthcoming):

1. Interconnections of modularization and [open] innovation are viable in the design-driven industries, thus outside the already examined fields of research.
2. Firms shifting toward openness of design do that to boost innovation, while creating hybrid forms of openness. Firms that constantly reconsider and explore openness, do that for various reasons beyond broadening innovation options.
3. Modularization creates entry points for innovation that can be effectively mined out by openness of design.

DOI: 10.14267/phd.2016007

4. Emergent forms of open [collaborative] innovation reshape firm boundaries, and reshaping firm boundaries evoke emergent forms of open [collaborative] innovation.
5. Modularization can be understood and analyzed beyond production/ organization. It is also about conceptual approach to design an object.
6. Modularization can serve both economies of scale and scope.

I scrutinize how modularization is adapted to production in the design-driven industries, structured by the following research questions:

- How do companies innovate mining out possibilities stemming from modularity in the design-driven industries?
- How can benefits of innovation openness and modularity be mined out in the design-driven industries?
- How can modular design be understood in the semantic realm, and what are the consequences for production?
- What is innovation openness, and where is the locus of innovation?

What is This Book Not About?

I do not refer to any other discourses outside the scope of this book, explicitly for the sake of a lean structure and argumentation as I stressed above. Hence, I demonstrate the power of the above theories backed by empirical findings, while leading the reader along a path full of adventurous challenges, not losing sight of the clearly defined direction at the same time. That said, I am explicitly not working with sociology or anthropology of arts, social behavior, theories of class, any scholarship related to social behavior as I rely on behavior of economic agents, neither I rely on neoclassic understandings of supply-demand, growth, or strategic behavior.

If one searches for the grand theories or the arguments of brilliant and classic scholars in these realms, hardly will find any of them in this book, due to the above exposed reasons. However I do indicate the legacies of

DOI: 10.14267/phd.2016007

theories from where the theoretic frame and argumentation of my work derives from closely.

Background and the Problem

Objects are created, but how to construct them to be valued? Design is a set of rules on how an artifact shall be made, but where do these rules come from, and how are they defined to be feasible to produce?

A craftsman creates with his tools inspired by surrounding objects, needs and visual elements. If designing and producing for the masses, one needs to take into account economies of scale and available resources. But where does knowledge on what is valued by the users come from? How to bring in line the tapped and perceived needs, production possibilities and adjust the boundaries of the firm? How do different cooperation forms emerge, and what is exactly what scholarship refers to as openness? How can constant innovation prevail at the same time? In search for answers to these pertaining problems I needed theories that explain innovation from broad toward the close up, here I give a brief overview.

Innovation as Adaptive Behavior and Evolution of Technology

Economic change, specifically how economic players adapt to the uncertainty of the environment, and how the fittest are being adopted by the environment has been long theorized and researched. New industries emerge crowding out old ones, where some branches survive through mutation as they change their organizational form of production, or develop new products/ services. *Creative destruction* [Schumpeter 1934] replaces the old with new firms and industries. Innovation as a result of trial and error in adaptation strategy fosters the economy.

Organizations follow a conscious adaptive behavior, where choices of firms on survival strategy differ bringing variability within the population, and enhancing the fitness of the industry as a consequence. In sum, creating new forms and carrying out new combinations lies at the heart of innovation driving the economy [Schumpeter 1934, Penrose 1952, Cohen and Levinthal 1989].

DOI: 10.14267/phd.2016007

Scrutinizing firms from a close up, and looking for genes, Nelson and Winter define innovation as *change in routine of the organization* [Nelson and Winter 1982, p. 128], where considerable *diversity of behavior* is assumed. Alongside the conservative firms in the economy, for-runners are adapting to the constantly changing environmental setting. Those who deconstruct the existing patterns, and learn through trial and error take a considerable risk [Alchian 1950]. This investigation entails to highlight open and participative forms of the innovative process that stretch organizational boundaries and modifies routines.

Organizational routine is a pattern of actions carried out by a set of actors within the organization [Nelson and Winter 1982]. These various actors share complementarities in behavior, which are reflected in the organizational routines (in other words linked behavior), and enhance capabilities. Routines themselves show complementarities, and the different actions within the organization and actions external to the organization are interdependent. We know, that an intelligent collective action emerges based on reciprocal interdependencies where the individual actors' behavior is not optimal [Levinthal 2000]. An effective adaptive system is 'able to link individual behaviors into larger assemblies of action' where hierarchy and authority create subassemblies of action [Levinthal 2000, p. 365]. Changing routines can raise the capabilities of a firm by shifting the boundaries of knowledge, thus meeting the challenge of innovation [Henderson and Clark 1990]. Companies [in the sector of knowledge-intensive business services: KIBS, see later] for example delivering innovation and design as a service, foster this change of routines within the firm.

The capability theories of the firm investigate organizational routines, capabilities, and competencies to explain inter-firm comparative differences [Fujimoto 2000, p. 246]. These knowledge-based theories of the firm introduce dynamics, but still lack the capacity to grab the constantly shaping formations overarching firms. Here we leap toward

DOI: 10.14267/phd.2016007

more dynamic frames capturing the fluidity of industries, and innovation dynamics with the theory of modularity.

The perspective of technological change and evolution of industries has been present in literature for long [Schumpeter 1934, Schumpeter 1950, Nelson and Winter 1982], where technology management [Henderson and Clark 1990] interplays with innovation and industry evolution [Malerba 2005].

Modularity Scholarship and Innovation

Scholarship on modularity has extensively covered the problems of modular systems of production, the trade off between modularity and integrality, challenges of protecting intellectual property rights related to modularized open systems, as well as the mirroring hypothesis, thus how and when do organizations mirror the modularization of production [Langlois and Robertson 1992, Sanchez and Mahoney 1996, Colfer and Baldwin 2010], as well as the connection between the modularization of industry structure, and product architecture [Parnas 1972, Simon 1962, Baldwin and Clark 2000, Ulrich 1995, Sanchez and Mahoney 1996].

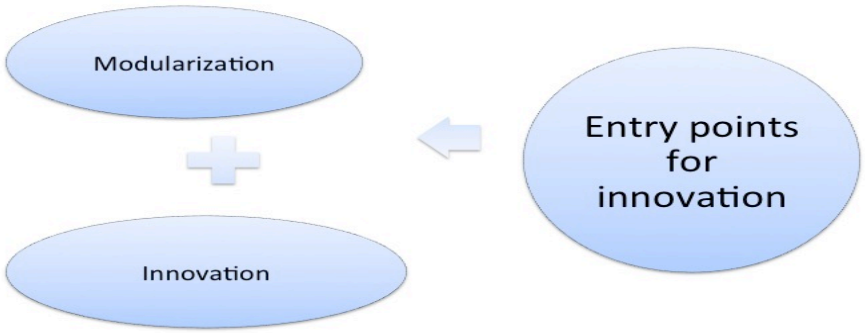
Moreover, industries are not what they used to be, we saw a shift toward de-verticalization of production for example in electronics and computer industries [Langlois 2007, Baldwin and Clark 2000]. There is a paradigm shift in what we understand where innovation comes from as might be the user [Von Hippel 1976, 1988] or a community of innovators despite the classical theorizing about the producer's role [Baldwin and Von Hippel 2011]. Furthermore, through modularization and free revealing [along with encapsulation] platforms can organize industries [Gawer ed. 2009]. We also know that enterprises produce brands rather than goods, as the production of goods is organized through supply networks or outsourced as a pattern [Klein 2000] in the US. Outsourcing is related to the increasing needs for specialized knowledge in design, manufacturing and production, that reshapes the coordination of *knowledge* of the enterprises, and questions again the boundaries of the firm as well as the traditional way of approaching them from transaction costs analysis, suggesting to

DOI: 10.14267/phd.2016007

see an organization as a network of firms cooperating in design, manufacturing, and marketing [Brusoni, Prencipe, Pavitt 2001].

The main problem this research tackles within the connection between modularity and innovation is how openness and modularity create entry points for innovation. My analysis focuses on the artifact designed both on a semantic level and from the production side. Studies on the history of design do use the notions of *modular*, *mass-produced* and the role of the designer or coordination process of design and production [Mañá 1973, de Fusco 1993, Koening 1981, Bersano ed. 2009, Aurichio 2012, Casciani 2014]. There is also scholarship on collaboration of firms [Pisano, Verganti 2008, Dell'Era Verganti 2010], on the emergent form of self-production or open design and innovation [Bianchini, Maffei 2013, Maffei], making and co-design [*CoDesign: International Journal of CoCreation in Design and the Arts*].

Figure 1 Modularization and Innovation Creating Entry Points For Innovation [J. Faludi]



The gap here I address is the systemized approach of understanding innovation and design openness [the problems of free revealing, permeability of the firm, property rights and boundaries of the firm] from the perspective of modularity. I chose the field of design-driven industries of Made in Italy, as it was not scrutinized from this view. My examples come from the classics of design, as well as today's production, with a special focus on furniture (arredamento), and with an open eye on other

DOI: 10.14267/phd.2016007

fields: some examples come from architecture, or everyday objects. I also draw on the different shades of innovation openness from the perspectives of permeability of the firm toward the outcome of innovation as a public good. I rely on different forms of production, that of the established enterprises ranging to self-production.

DOI: 10.14267/phd.2016007

The Contribution of This Research: Main Findings and Implications

This research first of all, contributes to innovation and modularity scholarship by adding findings in a less explored field, broadening the scholarship on modularity and [open] innovation beyond the realm of technology-intensive industries [computers, semi-conductors, automotive sector, open source software development, etc].

Second, it adds to theory by

summarizing:

- open/ user/ collaborative innovation scholarship
- links between modularity and innovation
- and understanding the relationship of modular design in the history of design and architecture;

also elaborating the:

  - Semantic frame of innovation: where the product is an architecture of meanings
  - Framework for understanding stylistic realm of conveying meanings and innovation
  - Linking modular design of products as a conceptual approach [aesthetics] and linking it to production from an evolutionary perspective

Main findings are accordingly in the theoretic realm:

By exploring architectural innovation [Henderson and Clark 1990] I found that core design concepts that define the direction of technological improvements enter the conceptual frame of innovation:

- What was interpreted as ‘values’ by the company defining the design, are proven to be core design concepts in the conceptual frame, as they define here a technological *and* conceptual [stylistic] frame.

DOI: 10.14267/phd.2016007

- Thus, architecture draws here a semantic and aesthetic frame of conveying meanings. [Not just merely defining the technological construction of the artifact described by the interaction of the elements].
- *Procedural innovation* [coined by me]: the effort that evolves around the main objective to most efficiently elaborate on the core design concepts in technological, and semantic realms.

Further findings of the case studies suggest that open methodology of design and innovation is prone to come from third parties to established firms:

- open design methodology as a communication strategy that contributes to innovation practices of the company, and not as a conscious strategy coming from the other way round. Here technological and communication tools are intertwined, as they are conveying meanings defined by the core design concepts
- it created a hybrid model of involving incentivized maker communities to channel in their knowledge in digital fabrication

Companies might rely on third parties to innovate and design their new products or redesign the organizational routines in order to create fertile environment for innovation. Knowledge-intensive Business Services are rendered in the form of innovation and design. Services are prone to be modularized in their being productivized:

- These schemes create patterns of client co-creation toward co-design
- there is a demand for knowledge on how to innovate [know-how]

Implications of this research on how we understand:

Openness

I systemize the available scholarship on openness covering open innovation, user innovation, collaborative (open) innovation and beyond. First of all, I systemize this scattered field based on the locus of

DOI: 10.14267/phd.2016007

innovation, transaction costs, organizational arrangements, and the outcome of innovation. By this I develop a framework of analysis, that I apply to the cases scrutinized here. Second, as the analyzed cases bring into forth hybrid arrangements and forms of innovation openness, I make my suggestions on understanding these emergent forms.

Innovation Scholarship

The locus of innovation turns out to be the hardest to find. Innovation does not seem to exist in its crystallized form of a mere adjustment and improvement of a product, or shaking the ground with radical solutions stemming from a producer. Neither style and technology exist in their separate ways, stylistic and technological innovation can complement each other, being intertwined, or substitute each other in a dynamic perspective of firm performance. In the production of such goods, as kitchens for example the push for launching new products creates the need for quick response, where finding and elaborating new technological solutions require far more time, in these cases style gains more focus, while technological design takes its time.

Organizational Theory

The fieldwork in Italy approved the stance of an enterprise being a node of design concepts and marketing communication, where branding plays a crucial role. We know that the idea behind enterprises of US in the global context in the last decades is to produce brands, not products [Klein 2000]. From an institutionalist perspective the firm is a nexus of contracts with suppliers, distributors, showrooms and a portfolio of designers. What I found, is that production, marketing, distribution and even design is done by third parties, where core design concepts [values] are defined by the enterprise. These findings call for a reexamination of the boundaries of the firm: what are the core capabilities and functions.

What scholarship calls *producer* for the sake of clarity in theory is as a matter of fact a *brander* thus a coordinator or producer of design concepts in line with the strategy and meaning of the brand.

DOI: 10.14267/phd.2016007

The perspective here shifts on the importance of brands, rather than production. These findings shall be further investigated in my future research with more empirical investigations and case studies.

Moreover, apart from the above-said, enterprises might face obstacles in innovation, design and even branding, where they turn to third parties, KIBS [knowledge-intensive-business service providers] that might even reshape their organizational routines not just taking over and delivering the required function.

Linking the Global to Local

As mentioned before, the fieldwork I carried out in Milan, region of Lombardy, Italy [apart that I visited Pordenone, region of Venezia-Friuli for studying Valcucine], where most of my interviewers were located.

As an implication for further research, the problem raises: companies rely on a web of external parties for producing, design, working with global portfolios of design, answering global needs of the global market. However, locally since the past decades higher education institutions providing a variety of courses in the field created an abundant pool of creatives. The interviews reviled that young designer have difficulties in finding jobs/ work due several reasons: 1) companies work with global portfolios of designers, 2) they have their own defined vision on design and production, 3) hence not open for prototyping the designs and ideas of young designers coming from outside of the company. On the other hand 1) technological advancement, 2) cheap prototyping opportunities, 3) and diverging (local) user needs and (global) production created the field for self-producing, and makers. Designers can individually prototype their artifacts, and even produce small-scale. There is a growing supply of products that can be configured by the individual user online applying the app of the designer, and then have it printed either in a local fablab, or receiving it by mail from the designer/ self-producer. To this field are connected the makers who have different backgrounds, but mainly related to design. They form communities, offline communities co-creating and

DOI: 10.14267/phd.2016007

sharing knowledge in local fables, however connected to global nets of makers, digital fabricators.

A further research outlook would be on one hand to see the connection of creative class, and local creative capital within the globalized production and design, on this specific field: Milan and Torino in Lombardy. On the other hand an interesting question to look at is how these pools of knowledge could be connected to the enterprises by creating and strengthening local institutions. Makers have their advantage being connected globally: thus reaching global communities, and access a global pool of knowledge, and yet acting locally through fablabs providing infrastructure for fabrication sharing and collaborating, furthermore valuable connection to third parties. Developing collaboration schemes of local firms that need solutions and fablabs mobilizing maker communities could be a field for local authorities to invigorate, or an opportunity for fablabs to grow.

Intro 2. Methodology

Innovation scholarship measures innovation through technological, qualitative change, and change in organizational routines and capabilities. There is also a broad scholarship on measuring Research & Development investment, activities and a growing body of studies on open innovation based on quantitative analysis. Despite the vast literature on measuring innovation activity in different sectors of production, creative industries challenge scholars in this respect. As my focus falls on open innovation and modularity I draw on the empirical and theoretic scholarship in the next chapters, where the adequate references are indicated. Moreover, innovation is mostly investigated from well-segmented and defined angles. The explorative nature of this work suggests a more complex view of innovation. In search for the locus of innovation, what exactly drives the emergence and elaboration of new ideas and how it is transformed into production I had to omit the possibility of any quantitative approach, as the answers laid behind the well-defined questions and data. I faced the field with a synthesis of the theoretic and empirical lessons brought

DOI: 10.14267/phd.2016007

together as a frame for understanding what I tap. I draw on the specific context of the story and contemporary discourse on Made In Italy and Italian design, to get closer to the specific features of design in a contextualized frame. This helped me to refine my theoretic frames for the field of Italian design: how do the participants of the field understand design and innovation in its multifaceted representation [I write about these in the next chapters]. Finally, case studies proved to be the most adequate approach for this explorative work to answer the research questions.

My approach relies on a combination of tools: direct observation, unstructured conversations, and constant reading at the first phase, which is followed by a more target-oriented data collection based on primary and secondary literature, and semi-structured interviews. After mapping a series of cases, I narrowed my attention to some of them, which are included in this book. The cases to be included and analyzed were chosen according to how they fit the line of argumentation. Some cases were selected after running the interviews, and some cases did not fit this book due to various reasons, but mostly due to streamlining the architecture of the discussion. Specifically, I was looking for cases illustrating and at the same time stretching the empirical findings presented in related scholarship. I focused on examples of collaboration, open innovation, as well as I intended to highlight different colors: from makers to established companies of production. The chosen case studies illustrate a phenomenon analyzed and to reveal a process [Siggelkow 2007], so they suited for exploring organizational and managerial processes.

We also know that case study is a

> "research strategy which focuses on understanding the dynamics present within single settings" [Eisenhardt 1989, p. 534].

Moreover, we know, that atypical cases offer opportunity to learn [Stake 2003, p. 152]. As already said, I rather focused on grabbing various cases than searching for the general.

DOI: 10.14267/phd.2016007

As this research focused on “how” and “why” questions, and the focus was on a ‘contemporary phenomenon within some real-life context”, the cases presented are *explanatory* ones as striving to look behind the “hows” [backed by *exploratory* and *descriptive* approach [Yin 2003, p. 1]].

The Toolkit

Desk research as explained above served for understanding the context, I visited several libraries going through a wide range of available resources, partly quoted in the References.

Interviews served two basic purposes: to understand the discourse and meaning of Italian design and innovation, thus contextualization, and to develop the case studies. I relaxed the semi-structured interviews adjusting to the experience of the interviewees and their willingness to talk about the projects, or activities.

To kick off an interview is suggested with “*a question, which the interviewee can answer easily and without potential embarrassment or distress*”, while another approach relies on the tradition of “*request for factual or descriptive information can be useful opening questions*” [King 1994, p. 21]. In this realm and due to time constraints of the respondents, carving out their time from their busy schedules, were asked to provide with their own understanding and definition of design.

As my case studies were different, and I was interested in their specific details and context, there were no identical interviews neither in respect of the set of question, nor how the interviewees approached their answers. Noting, that a good case study investigator shall “ask good questions” and be “a good listener” and “adaptive and flexible” at the same time to interpret and not to be trapped by own preconceptions [Yin 2003, p. 59]. The questions themselves were unfolding adapted to the flow of conversation, of course always keeping in mind the structure that I elaborated previously. The discussion itself in many cases continued after stopping the recorder, sometimes important information laid there: not recorded. In these cases I jotted down my observations in a diary

DOI: 10.14267/phd.2016007

afterwards. As the interviews were taken in Italy I preferred running them in Italian. This served several purposes: to relax the respondents from the constraint of answering in a non-native language, and most important to allow for the toolkit of definitions and notions specific for Italian design as it is used in the discourse on design in Italy [see forthcoming in the next Chapter].

The toolkit developed in this analysis is based on different sorts of qualitative traditions. In its stance aimed at understanding, exploring, 'the world' through not just observation and interpretation it can be connected to the '*interpretivism*' *tradition of qualitative social research*. Weber "*proposed two types of understanding: direct observational understanding, and explanatory or motivational understanding*" [Ritchie, Lewis 2010, p. 7]. This research pulls the benefits of both types of understandings: observation, and conducting the semi-structured interviews provided means of a holistic understanding of the field, its actors, their environment. Content analysis of the texts provided floor for conceptualization and introducing theory in the deconstruction and then in the process of building up the mechanisms, and causal relations. I relied on the text of interviews as a substantial source for theory building extending the adapted theoretical frames [of innovation literature, modularity theory, and theory of the firm]. At the same time I relied on the reconstruction of the cases/ projects mostly based on the information provided by the companies and the field, where problems of data validation emerged, that I will reflect upon in the forthcoming columns. The case study of Valcucine was based on a field visit to Pordenone, Italy. I used 30 interviews all in all with art directors, academics, journalists, designers, curators, creative directors and managers taken in companies and venues in Milan, Italy. Many times these roles overlap as one might work in several functions during his/ her career.

I used data triangulation to explore the case, and to add validity [Arksey and Knight 1999, pp. 21-31] for including secondary data collected from the websites of the companies at stake and from the materials provided by

DOI: 10.14267/phd.2016007

the companies themselves. An important constraint of the research was time and money for heading for a more profound or broad interrogation. Another constraint stems from the structure of this book. As I was willing to picture a colorful map of design in Italy, a more profound and focused analysis of a specific type of company, or practice in production is not investigated on a large series of data. It is also connected to the fact that I was explicitly aiming at

1. exploring,
2. mapping,
3. understanding, and
4. modeling

rather than testing a specific set of hypotheses. I consider this research an explorative, qualitative one, twisted with a clear-cut analysis based on the theoretic frames exposed at the beginning. I spend some words on relevant methodological questions in each related chapter.

Limitations and Obstacles

There were further obstacles to this research. First of all, contacts for interviews had to be collected on spot, in the showrooms, as in several cases websites do not give direct access to communication managers, who are usually responsible for handling interview requests. The path within the hierarchy of these companies goes through the responsible for communication/ PR of the company. Even if I explicitly mentioned that I would love to have access to several layers within the production and design departments, those are arranged by the communication department. This was mainly true for the furniture/ lights/ etc. companies. In the case of KIBS the situation was easier, as contacts are available on the website, where one almost directly gets to the level responsible for design [researchers, art directors]. I contacted my interviewees through email, presenting the project and requesting an interview with a possible site visit. Responses in many cases were scarce, and it took several further emails, reminders, in some cases telephone calls, to humbly draw attention

DOI: 10.14267/phd.2016007

to the request. In many cases the companies were not available for an interview and asked me to send the questions in written. As this research was aiming to explore and mine out information beyond what can be obtained through a questionnaire with diverse cases, these I decided to eliminate from this scope of research, and get back to them in a further one [possibly with questionnaires]. In other cases it took some months to get an appointment [after several reminders in email and in person at the showroom in Milan]. Companies did not make it possible to access their financial data, reports, documentation. However they were very available for providing me with their booklets, and catalogues, that are handled over to their business partners, or journalists. Within the framework of this research, thus, there was no opportunity to go beyond these information by spending a considerable amount of time on site talking to designers, and digging documentation. Some of the companies have their museums [*museo d'impresa*: enterprise museum] telling the [innovation] story with objects exhibited and guided tours. Some of them maintain a library collecting considerable documentation on design [for e.g. Alessi] available on appointment. Campari for e.g. provides with the innovation story of its communication strategy and branding [as the liquor itself has not changed]. Museums provide opportunities for events for outside companies: reception, conference, etc [Campari in Milan, or Cimballi or Kartell in the outskirts of Milan], which generates revenue, and adds to the branding strategy. Guided tours are on appointment and free of charge. In contrast, for e.g. Alfa Romeo, or Versace [to bring an example from fashion] collects and entrance fee, and Alfa Romeo provides guided tour for a considerable fee. In the case of Alfa Romeo, the museum itself follows a different path than the above examples: the exhibition is curated to give an 'experience', to provide the service of entertainment to the visitors [with a 5D movie trailer at the end], while Versace does not bother for constructing a narrative of evolution/ change, rather focuses on presenting its selected clothes. Others present their stories on their curated websites [like in the case of Valcucine or others in furniture design]. Companies contribute to the construction and documentation of the history

DOI: 10.14267/phd.2016007

of design [documentation center at Alessi, or the finely curated exhibition on the history of coffee-makers of Cimballi, presenting several brands and producers, providing with a broad overview of the sector]. The innovation stories of these companies analyzed here are thus constructed relying on the narrative provided by the company itself. There are also available books on the story of kitchen design, fashion etc. that are sold on the book market and backed/ or in some cases published by the companies themselves. These editions, exhibitions, museums, events, etc. are the bricks of the constructed story of design and innovation, produced by the companies themselves. Following a rather critical approach the researcher might decide to look beyond the significance and checking the reliability of the presented data, aiming to reconstruct the actual significance of these innovations back in time and their impact on the industries and the market. This line of research would add a verification and possibly a deconstruction of the narratives created by the companies. This research however, did not follow this line, in that it simply relies on the discourse available at hand. What I did in this situation, is I added the frames derived from theory to understand and focus on the dynamics, openness and type of innovation to the stories provided by the companies and field.

However to add some critical shade, I used expert interviews [academics, journalists, designers] to understand the discourse on Italian design, and to progress with sampling.

What Was Gained by the Obstacles?

The above mentioned obstacles of data validation however, brought about some valuable results. As the perspective shifted from the critical reconstruction of stories of innovation toward the analysis of the stories stemming from narratives of the companies [nested in the discourse], values communicated by the companies could be taken into account and brought in line and analyzed how they relate to innovation. One important theoretic contribution, *procedural innovation* [see later], was possible to find exactly by understanding what was communicated by the company [Valcucine] on its own innovation and communication strategies.

DOI: 10.14267/phd.2016007

This perspective brings this study closer to relate to the field of company strategies, and branding in this respect.

Research Design

Most important steps of research design were [following and inspired by Yin 2003, pp. 21-28]

*1. Identification of the **research questions** around How? Why?*

- How do companies innovate mining out possibilities stemming from modularity in the design-driven industries?
- How can benefits of openness and modularity be mined out in the design-driven industries?
- How can modular design be understood in the semantic realm, and what are the implications on production?
- What is innovation openness, and where is the locus of innovation?

*2. **Assumptions: there are no hypotheses as this research doesn't test but explores***

The assumptions formulating the research questions were stemming from the findings of scholars, and my preliminary investigations on the field. These assumptions are as follows:

DOI: 10.14267/phd.2016007

7. Interconnections of modularization and [open] innovation are viable in the design-driven industries, thus outside the already examined fields of research.
8. Firms shifting toward openness of design do that to boost innovation, while creating hybrid forms of design openness. Firms that constantly reconsider and explore openness, do that for various reasons beyond broadening innovation options.
9. Modularization creates entry points for innovation that can be effectively mined out by openness of design.
10. Emergent forms of open [collaborative] innovation reshape firm boundaries, and reshaping firm boundaries evoke emergent forms of open [collaborative] innovation.
11. Modularization can be understood and analyzed beyond production/ organization. It is also about conceptual approach to design an object.
12. Modularization can serve both economies of scale and scope.

This research contributes to organizational science, innovation scholarship and literature on design.

3. Unit of analysis:

Project, organization: depending on the case.

4. Analytical frame for linking the data to the propositions:

is presented in Chapters 1.1 and 1.2

5. Normative frame for interpreting the findings:

is presented in Chapter 1.3.

6. Theory development: is the connection of modularity and open innovation, and that modularity + innovation structures are viable in design-driven industries.

The different cases covered:

DOI: 10.14267/phd.2016007

Modularity and innovation from a historical perspective	Kitchen design, story of innovation of valcucine Dynamic one-case study Unit of analysis: firm [innovation strategy of a firm through series of projects] To understand innovation controlled by designer-entrepreneur over a network of suppliers To understand how innovation benefits from modular production
Open innovation, collaborative innovation, modularity	Kitchen becomes open One-case study Unit of analysis: project To understand open innovation and open collaborative innovation in design To understand how modularity creates entry points to innovate for communities
Collaborative innovation, design	KIBS firms Two-case study Unit of analysis: firms [approach to collaboration] To understand collaborative innovation and design and innovation rendered as a service How innovation is rendered as a service and being modularized

My toolkit, thus what I scrutinized in each and every case:

- I always concentrated on the development and production-side
- interaction of the players [nested into an ecosystem]
- how the players shape the discourse by contributing to it, and how are they shaped by the discourse

DOI: 10.14267/phd.2016007

For validity I used multiple sources of evidence, and aimed at having key informants to review the draft [Yin 2003].

A single-case selection rather than a multiple-case design is valid if the single case represents the "critical test of a significant theory" [see Gross et al. 1971: Implementing Organizational Innovations. referred to by Yin 2003, p. 41]. I didn't chose it for the purposes it was a representative or typical case, but because it was interesting for gaining evidence to the theory. I chose Valcucine for understanding its path toward openness, and due to its radical solutions. I chose Frog and Continuum for being different but still in the realm of global KIBS in design, to understand collaborative innovation.

Data Analysis

I relied on the theoretical and analytical frames suggested at the beginning of the book, when analyzing data of the case studies. The interviews of the key informants were recorded, while observations noted.

Limitations

The limitations derive from the method, as case studies are "generalizable to theoretical propositions and not to populations or universes" [Yin 2003, p. 10]. Thus it is purposeful for analytic generalization demonstrating the power of theories on modularity and open innovation.

In sum…

This study is based on an exploratory research, where the intention was to tap patterns, interactions forming behavior in the realm of innovation openness. Despite that my attitude as a researcher was that of experiencing with a 'fresh eye', based on semi-structured interviews, observation, and documentation [photos]. Preliminary research helped to reveal the gaps.

I scrutinize and analyze how modularization is adapted to production in the design-driven industries. However, I do not picture neither relationships, no production processes or organizational arrangements here with the available toolkits: network graphs, design-structure-matrices

DOI: 10.14267/phd.2016007

[DSM] or layer maps [Baldwin and Woodard 2009] as the main intention of this work is to see how paths for innovation are created, with a special focus on open innovation.

I do, however, use photos and pictures of objects, buildings, furniture, ceramics, or at times my own photos taken on the field. These pictures are an essential part of the argumentation presented, complementing the body of text on the different dimensions of modularity. I constrained my willingness to add further photos taken on the field that would have served merely to color the text. However, a smaller part of these is already available on my social media profiles, and soon a larger part of them will be available for illustrating this project, that hopefully will be extended in the foreseeable future.

DOI: 10.14267/phd.2016007

I Theoretical Framework, and Empirical Overview

We are living in the age of modularity. Producers decide on modularization to deal with complexity and high fixed costs. Complexity is further induced by the technologic advancement and the shift toward knowledge economy witnessed in last decades. With division of labor, functions, capacities, encapsulation, standardization of communication interfaces, etc, thus modularization of production within industries, complexity becomes easier to deal with reducing effort, time and costs. The story of modularity drives us from reaping the benefits of economies of scale toward creation of platforms for innovation, product diversification, benefiting economies of scope and economizing on the long tail structure of markets.

1.1. Complex Systems and Modularity

The theory of modularity in economics and social sciences stems from Simon's [1962] proclamation on the metaphoric power of theory of complexity, adopted from the natural sciences. How different systems are composed, and how the relationship of the elements can be redesigned in a manageable way, is what scholars tackled later on analyzing production systems. Modularization has its costs and benefits, and it can restructure a whole industry into a modularized system of production of vertical and horizontal arrangements.

In this Chapter I draw on the main findings concerning modularity, production and its relation to innovation in order to frame my investigation on innovation patterns in the design-driven industries. I also tackle modular design at a different level: that of in the aesthetic realm of objects, where modularity underpinning functionality, and cost reduction of production steps out to the stage of a shared language in the spotlight of consumers valuing meanings conveyed by the objects they use. I treat this

DOI: 10.14267/phd.2016007

symbolic and semantic mode of value creation from the perspective of modularity, where the relationship of whole and part is conceptualized.

How is this relation of whole and parts embodied? What are the main characteristics of a complex system encompassing these parts? Following Simon's [1962, p. 468] definition a *complex system* is:

> 'made up of a large number of parts that interact in a nonsimple way', and where
>
> 'the whole is more than the sum of the parts'.

Let me highlight thus the main features: 1. a complex system consists of parts, thus it can be broken into parts. 2. these parts interact, thus there is a predefined relation among them. 3. the interaction of the parts is non-simple [they have patterns of interaction], 4. the system has a higher value than just being a sack of parts.

Later in the text Simon reminds about the main features of how a system can be described. It turns out that complex systems can be easily, or non-decomposable, that elements can be more or less interdependent, or that there is a hierarchy of subsystems. Finally, combinations of the elements can be rearranged. What we learn in respect of production is that an effective rearrangement of the elements, for example dividing a task into well-defined hierarchy of subtasks, can raise the efficiency of production.

The classic example of the watchmakers Tempus and Hora illustrates how Hora by modularizing its tasks in assembling the watches proved to be more efficient than Tempus that executed an integral process of constructing a watch. Interruption during assembling of the watch caused Tempus to start the process from the beginning, while Hora managed to lower its loss in time and work load by picking up the process from the previously executed task. In the long run splitting the not less complex tasks into subassemblies made Hora competitive in contrast to Tempus, that failed to keep up with the pace, by losing man-hours when being interrupted [Simon 1962, 470-71].

DOI: 10.14267/phd.2016007

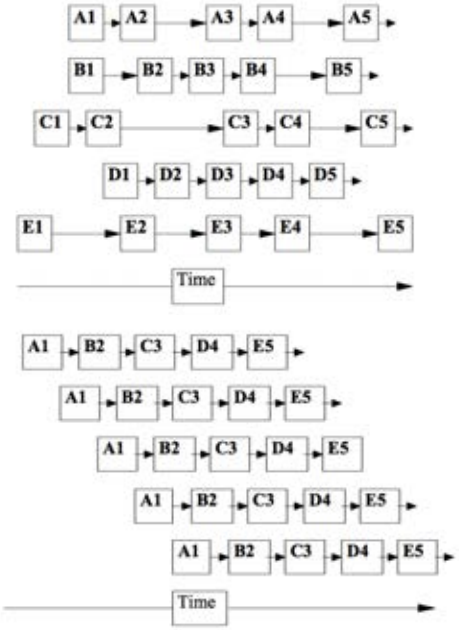
1.1.1 Division of Labor

Economic historians shed light on the importance of division of labor in the development of capitalism. I draw on Axel Leijonhufvud's [1986] study summarizing the arguments on the connection of division of labour, industrialization and mass production, and illustrate how it is linked to modularity framed by other scholars.

After introducing series of examples on specialized organization of labor grabbed from pre-capitalistic history, the study argues that Adam Smith and Karl Marx agreed that machinery development followed division of labor seeding industrialization. Adam Smith's classic example of pinmakers elucidates the shift from craftsmanship to factory production based on the division of labor. I use Axel Leijonhufvud's graphs to illustrate that [1986, no page] [**Error! Reference source not found.**Pinmakers in Craftsmenship and Factory, Figure 3 A Centralized and a Decentralized Network of Firms [Langlois, Robertson 1991, Fig. 4. and 5. pp: 300-301]]. On the first graph we see how one craftsman executes all the related tasks at their own pace. On the second one we can see how each task is being performed by a specialized worker. Series of tasks are executed in pre-defined pace and time, and workers can be easily supervised for their performance and effort, which suggests increase in productivity.

DOI: 10.14267/phd.2016007

Figure 2 Pinmakers in Craftsmenship and Factory (Axel Leijonhufvud 1986, no page)



We learn that the above reorganization of production implies benefits based on switching from individual to team production, saves on capital investment, and requires the standardization of the product, where each task becomes complementary of the other. Time-phasing of the inputs plays a crucial role, as well as the risk of falling out of one individual worker-input or working station, ending the production to zero. If the tasks are divided, only one set of tools is required instead of five, and the costs of switching from one task to the other are also saved. In a broader sense, specialization suggests saving on human capital, no master pinmaker is needed to execute the production. Economic history has witnessed horizontal and vertical division of labor in industries, where the later has born its social consequences. The division of labor has a lot to do with social implications, which I am not focusing on here. By entering mechanization into some stages of production, it can be further speeded up, by regrouping human labor force. Without presenting here the detailed argumentation, we might conclude that increasing division of labor not only within, but among firms along with mechanization brought about growth and increased economies of scale in the industrial capitalism.

In sum, along with the above arguments, division of labor contributes:

DOI: 10.14267/phd.2016007

- to organization of mass production
- to diversification of knowledge and capabilities: which caused the lowering of human capital investment by entering machinery in the rise of industrial capitalism,
- to flattening production

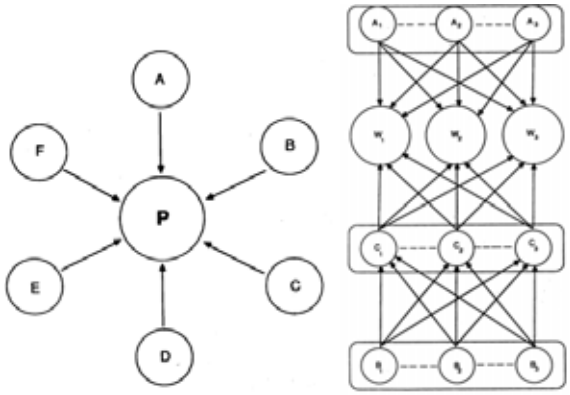
to division of intellectual labor: which might contribute to lower human capital investment [see the example of hairdressers in computing: Langlois and Garzarelli 2008], or the contrary: require increasingly specialized knowledge that implies investment to obtain it, as seen in the knowledge economy.

1.1.2. Division of Labor and Modularity

An industry might benefit from the division of labor underpinned by modularization of the product, and the production process. Firms might divide production tasks, where different components are produced by different entities, and assembled into one product either by a central firm, or by the user [benefiting from the product]. The division of components thus implies standardization, complementarity and coordination of production. This might take the shape of decentralized or centralized production over networks of firms [see graph below]. In the first picture suppliers are tied to a lead firm. In the second picture: B_1-B_3 are makers of subassemblies to C_1-C_3, A_1-A_3 and C_1-C_3 are manufacturers of A and C, components of systems W. Division of labor can spur innovation requiring little or no coordination among the components. Langlois and Robertson [1991] illustrate that with the cases of high-fidelity and stereo systems, and examples from microcomputer industry.

DOI: 10.14267/phd.2016007

Figure 3 A Centralized and a Decentralized Network of Firms [Langlois, Robertson 1991, Fig. 4. and 5. pp: 300-301]



1.1.3. Modularization

The question on how to exactly modularize production, and what modularity meant still needs to be explored. To answer that I rely on the seminal work on *The Power of Modularity* [Baldwin and Clark 2000] conceptualizing modular design from an historic and a structural point of view. In the seventies the computer industry skyrocketed in the US. What Baldwin and Clark found studying the matter is that by that time computer products were modularized, that had implications both on the enterprise design and the industry structure. I rely on their consistent system of conceptual framework that I highlight here in their main points.

First, let me get back to where I started with understanding complex systems, where interacting elements make up a whole, and the whole can be decomposed [or non-decomposable as a system]. If we decide on decomposing it, where would the boundaries lay? Before answering that question let us see what modules are.

“A module is a unit whose structural elements are powerfully connected among themselves and relatively weakly connected to elements in other units. Clearly there are degrees of connection, thus there are gradations to modularity” [following Baldwin and Clark, 2000, p. 63, adapted from

DOI: 10.14267/phd.2016007

McClelland and Rumelhart [1995]. Parallel Distributed Processing, Cambridge Mass., MIT].

From the many listed approaches, Baldwin and Clark [2000] describe modularity through the relationship of modules to the structure, and not based on their relation to functionality. This implies, that modules are: 1. interdependent, 2. embedded into a framework of the system, the *architecture*. Furthermore, architecture specifies what modules will be part of the system, and what their roles will be [Baldwin and Clark 2000, p. 77].

To manage a complex system, it can be divided into smaller pieces that can be looked at separately. How to find those natural points of division among the pieces, is the secret of modular design. Before going on with the benefits and costs, let us see the tricks and tracks of modular design.

As mentioned above modularization aims at creating independent blocks of elements, interacting with each other in a regularized manner. The rules of interaction are specified in the interface of the design. Modules contend invisible information that is not part of the interaction. Interfaces constitute of visible information, if partitioning information of the system [Baldwin and Clark 2000. pp. 73].

The technique of *information hiding*, or *encapsulation* of the information that is prone to change independently within the module is referred to originate from Parnas in [Langlois and Garzarelli 2008, Parnas 1972] in order to ease the communication between the modules and to create as much independence as possible. The architecture provides with independence of the modules, while *standards* test the conformity of modules with the design rules [Langlois and Garzarelli 2008, p. 130].

The interface “is a pre-established way to resolve potential conflicts between interacting parts of a design. It is like a treaty between two or more subelements. To minimize conflict, the terms of these treaties – the detailed interface specifications – need to be set in advance and known to the affected parties. Thus interfaces are part of a common information set

DOI: 10.14267/phd.2016007

that those working on the design need to assimilate. Interfaces are visible information." [Baldwin and Clark 2000, p. 73].

The relationship between hidden and visible information is represented by the *design hierarchy* that maps features of design: 1] who has to know what 2] the temporal order of decisions, 3] the reversibility of different choices.

Complete set of design rules contend design information on:

- interfaces: descriptions on how modules will interact, fit together, connect, communicate, etc.
- integration protocols and testing standards: procedures that will allow designers to assemble the system and determine how well it works, whether a particular module conforms to the design rules and how one version of a module performs relative to another. [Baldwin and Clark 2000, p. 77]

In sum, modularity works at two levels. First, it simplifies complex processes of production. See the table above, where different components are manufactured by different suppliers, and then assembled together at one site, for e.g. in car production, or kitchen production [see forthcoming Chapter]. Second, modularity in use serves consumers to mix and match elements to come up with a final product that suits their different tastes and needs. Modularity in use can spur innovation: the manufacturers can independently experiment with new products and concepts [Baldwin and Clark, 2000, p. 78]. The case study of Valcucine, that I present in the next chapters serves as an example for both functions of modularity. A supplier net of manufacturers producing standardized and complementary parts assembled together and at the same time mining out the benefits of customization. Moreover, I serve with examples on how it creates entry points for single-user, and collaborative innovators to contribute to the design of the complementary elements [forthcoming]. After listing the costs and benefits, I explore the connection between innovation and modularity relying on the frame of Henderson and Clark [1990].

DOI: 10.14267/phd.2016007

1.1.4. Costs and Benefits of Modularity

Simon [1962] argues that complexity is a result of evolution and learning. As illustrated before, modularity serves for managing complexity by partitioning it into smaller elements, and by adding a set of rules. The classic example of Hora and Tempus [see above] where mining out the advantages of division of labor, specialization and modular production, breaking the making of a watch into sub-tasks, rewarded Hora with survival. Tempus died out due to the high integrality of its watches, interdependency of the tasks and unfinished products [see before, Simon 1962]. Production systems in a series of industries have met the challenge of complexity by partitioning tasks and players into modules, benefiting from reorganization of production. We know that design process of modularization however, implies costs along with benefits. Here I sum up the trade-offs between modularity and integrality based on Langlois and Garzarelli 2008, adding further points to the list.

The advantages [benefits] of modularity are:

1. **Minimizing communication costs** through information hiding/ encapsulation [see Parnas and IBM OS/360[1] in Langlois 2000].
2. **Economies of substitution** [Garud and Kumaraswamy 1995, Baldwin and Clark 2000], where system designers can easily substitute components, as suppliers work on an established technological platform.
3. **Intellectual division of labor**. We learned that local knowledge can be mined out through specialization and tap into "collective intelligence" [p. 131.], illustrated with the example of hairdressers employed [by M. Prony] to solve simple and easy-to-learn parts of

[1] where IBM OS/360 was constructed in a non-decomposable manner, and the project workbook where all the improvements were registered and suggested to be known by all the developers, became so thick, that it was unmanageable. By breaking the design and production process into modules and *encapsulating* knowledge within modules [suggested by Parnas], brought the process manageable.

DOI: 10.14267/phd.2016007

mathematical problems. The potential number of collaborators can be increased. [Langlois and Garzarelli 2008].

4. **Raise innovation opportunities based on architectural/ modular innovation** [Henderson and Clark 1990]. Where a firm searches for a broad range of possibilities to enter novelties, it might choose the strategy of modular or architectural innovation. Modular innovation allows for changing or updating only one or some modules. Architectural innovation recombines or rearranges the modules. Both ways might lower costs and efforts in contrast to systemic innovation.

5. **Raise innovation opportunities by creating entry points for innovation: openness [open innovation, open collaborative innovation].** Modular and architectural innovation can mine out possibilities deriving from the openness of the firm sourcing in knowledge and inviting contributors to innovate. Modular arrangement does not imply openness per se, however it creates more options to follow [Langlois and Garzarelli 2008, Baldwin and von Hippel 2011].

6. **Easy ways to change the design structure and raising option in the value landscape**. The six operators of modularity create options for innovation [Baldwin and Clark 2000, p. 423]: 1. splitting the design into modules, 2. substitution, 3. Exclusion, 4. augmenting, 5. inverting to create new design rules, and 6. porting a module into another system].

7. There is evidence that modularity serves **mass production** through **economies of scale** in the computer industry [Baldwin and Clark, 2000]. I will examine cases supporting these findings grabbed from the design-driven industries.

8. Producers benefit from **economies of scope** created by customization possibilities created by modularity [see examples in the upcoming chapters].

DOI: 10.14267/phd.2016007

The disadvantages [costs] of modularity:

1. **Coordination costs** due to bringing in line the modules into a well-performing system might increase.
2. When switching to a modular arrangement the **costs of switching**: establishing visible design rules, elaborating the standards can emerge.
3. **Lock-in** in a particular system, as systemic innovation is more difficult exactly due to the division of labor, and involving too many actors, and the need to redefine the standards.
4. **Benefit of integrality as cost of modularity.** Modular design is missing the advantages of systemic innovation of integral systems. Some products, for e.g. motors of automobiles cannot be constructed in a modular way to the extent as computers. Integral systems take the advantage of systemic fine-tuning to enhance the performance of a product [Langlois and Garzarelli 2008]. There is a threshold, where customers are willing to invest in enhanced performance.

I will deal with how modularity creates possibilities to innovate after I have systemized the myriad of approaches on open innovation in the next subsection. First, I show the relationship of modularity and innovation, and then open the box up.

DOI: 10.14267/phd.2016007

1.2. From Open Toward Collaborative Open Innovation

Starting from the Schumpeterian producer-driven understanding of innovation, followed by user-generated solutions and understanding of collaborative forms of co-creation, scholars investigated the drivers and the nature of interactions underpinning success in various ways. Innovation literature has gone a long way, where open innovation has attracted researchers to investigate problems like compatibilities of external resources, networks of innovation, or open source collaboration. Openness itself has gained various shades in the different strands of literature. In this chapter I provide with an overview and a draft evaluation of the different models of open innovation, illustrated with some empirical findings from various fields drawn from the literature. I point to the relevance of transaction costs affecting viable forms of [open] innovation strategies of firms, and the importance to define the locus of innovation for further analyses of different firm and interaction level formations.

1.1.1 Overview

From the perspective of how and when new solutions emerge, toward the relation between the capacities of a firm and compatibilities of external resources ending up in innovation practices innovation literature has gone a long way. Starting from the Schumpeterian producer-driven understanding of the emergence of new forms and products, followed by user-generated solutions and understanding of collaborative forms of co-creation, scholars tackled to investigate the drivers and the nature of interactions underpinning success. Ever since the scholarship of Institutional Economics firms tend to have their boarders viewed with well-defined activities, contractual relations and knowledge boundaries defining them. However firms tend to be fluid with overlapping networks, activities and ever-changing structures. Scholars argue for the presence of project-based organizations, overlapping knowledge structures, and forms of co-creation, which all imply the need for more dynamic view of the firm. Innovation, production and commercialization stages, viewed mostly as a linear process, seem to have kaleidoscopic arrangements overlapping

DOI: 10.14267/phd.2016007

firms, and follow a spiral-like shape driven by interactions in its development. Theory of modularity is at hand for describing and understanding these emergent, industry-wide structures on the level of nets.

With its broad and diverse use of the concept, open innovation is a specific field of innovation studies, which goes hand in hand with the different strands of organizational and industry scholarship. Scholars have long noted that firms apply external resources for innovation, and that there is more to adaptation than invention [Cohen and Levinthal 1990]. Open innovation lies in the wider context of institutional openness, and as a theory it has seen different conceptualization frames. Recent scholarship has shown that channeling in and out resources for innovation, requires organizational rearrangement toward openness with adequate strategy applied [Chesbrough 2006, 2011, Harison and Koski 2010]. A number of scholars have examined openness beyond its binary understanding of open and closed, rather as procedural or dependent on several characteristics [Van de Vrande et al 2009, Chiaroni et al 2011, Dahlander and Gann 2010, Barge-Gil 2010]. Some have argued for understanding openness where all related information is a public good [Baldwin and von Hippel 2011, and related literature on open source models [Lee and Cole 2003, Baldwin and Clark 2006, Dahlander et al 2008, Harison and Koski 2010, Méndez-Durón, García 2009]. In this paper I provide with an overview and a draft evaluation of the different models of open innovation, illustrated with some empirical findings from various fields drawn from the literature.

Although some identify not less than nine streams of perspectives examining open innovation [Gassmann et al. 2010], or three main approaches [Baldwin and von Hippel 2011], herewith I structure the strands into four basic categories, with implications of these strands explained later:

A] the user-oriented approach where the producer picks up solutions provided by those [who use the design and product or service single user,

DOI: 10.14267/phd.2016007

lead user, community of users following the definition of Baldwin and von Hippel 2011], in further developing and commercializing the product,

B] the *producer-focused model*, where it is the producer who drives innovation, and seeks for sourcing in external capabilities/ knowledge for finding new solutions, and adapts a business model in favor of that [by raising absorptive capacity, rearranging its organizational setup, etc.],

C] the role of *networks and ties in innovation* over firms are at stake, with a stream focusing on knowledge-share across networks, [loose coupling, etc.],

D] and investigations about *collaboration of firms or users*, modes of and incentives for co-creation for innovation, where the focus falls on interaction.

Open innovation has been investigated primarily on examples drawn from high-tech industries, however the scope of investigations has broadened since toward other industries [for eg. creative industries]. More to that, scholars apply theoretical frameworks to investigate how firms implement open innovation in practice as regards products as well as services [financial services for eg.] to illustrate the explanatory force of the different frameworks. Before going on with elaborating on these findings, let us resume the different conceptual approaches to open innovation.

1.2.2. Forms of Open Innovation

Going back in time following reversely the footsteps, one can recognize a definitive focus on technology-led production and innovation activities of firms, investigated thoroughly by scrutinizing the production process: stage by stage, firm by firm.

A) The User Model

Back in the seventies von Hippel [1976] spotted the pattern of user's involvement in product development and dissemination in the scientific instrument innovation process. Firstly, it was recognized that commercial success for industrial goods, stems from innovation projects in response to

DOI: 10.14267/phd.2016007

user need, rather than technological opportunity [von Hippel 1976. p. 213]. Based on a wide sample of scientific instrument innovations the study concludes that 80% of the manufacturers provide the product engeneering and manufacturing functions for innovative instrument users. This allows for understanding that **it is not the firms themselves innovative**, but rather the process, which allows for user dominated innovation pattern. Innovative firm means here a firm, which provides for new product development. Based on these findings, von Hippel elaborated the user-model of innovation, with a typical pattern of the user taking over the following steps [von Hippel 1976, p. 220]:

1] *invention, prototyping*: the user perceives that an advance in instrumentation is required, invents the instrument, builds a prototype, 2] *information diffusion* and 3] *pre-commercial replication and use*: proves the prototypes' value by applying it.

In this scheme the manufacturer takes over the commercial manufacture, market and sale functions. These functions can be stretched where the manufacturer tests, refines and improves the product in the engeneering phase. The *locus of innovation* [p. 227] here thus is the user. Broader implications of these findings are notably for governmental policy arrangements to consider users along with the manufacturers in designing incentive schemes. Through the case studies further patterns evolve [see p. 231], where another player: the material supplier for product, enters the idea formation, problem solving, solution and pre-commercial diffusion stages [material supplier dominant], along with the previously exposed: user-dominant, and commercializer-dominant [where the manufacturer takes over the process except for the user's recognition phase] schemes.

Firms can spot the lead users through market research. Based on the suggestions and views of the lead users, firms incorporate the revealed findings into their innovation activity [Herstatt and von Hippel 1991]. The method coined 'lead user market research' [carried out at Hilti AG, manufacturer of products used in construction] allows for a product development based on the involvement of a selected lead user concept

DOI: 10.14267/phd.2016007

group in the frame of a product generation workshop. Only solutions appealing to the typical users are elaborated which saves time and cost. The lead users are those who:

1) face needs that will be general in a marketplace before the bulk of the marketplace encounters them, and
2) expect to benefit significantly by obtaining a solution to those needs [Herstatt and von Hippel 1991, p. 2, following von Hippel 1986, 1988].

Users here serve as sources, where producers initiate innovation strategies through elaborated forms of channeling in ideas and needs. In the Sources of Innovation [1988] von Hippel scans innovations developed by manufacturers, suppliers as well as users and he finds that the functional source of innovation varies in fields. Furthermore along with users, product manufacturers or suppliers might take the role in innovation, along with trade in know-how. The model where users actively drive innovation either as single-users or a community represents a shift from this earlier model. User-only innovations can even create systems of innovation, where as a byproduct of dissemination even a brand is documented to be built in the case of Apache software community [Füller, Scholl, von Hippel 2013].

Users' incentives to innovate either as manufacturers for in-house use of solutions, or end-users of products and services are mainly defined by their benefit what they get directly from innovation. The profit though, that a single-user can obtain from the use of the invention or innovation, cannot compete with the profit gained by the producer from commercialization on a wide market. The producer's innovation is designed to serve many users with more investment available for product development. There are arguments on democratizing innovation [von Hippel 2005] based on an ever-widening role of users' contribution. The user approach of open innovation investigations is considered to be one of the most examined ones [Gassmann et al. 2010].

DOI: 10.14267/phd.2016007

B) The Producer Model

Following Schumpeter it is the entrepreneur, thus the producer who generates novelties in the economy taking a considerable amount of risk for heading [Schumpeter 1934]. Innovation scholarship thus tends to rely on scrutinizing the producer in order to understand the emergence of new solutions in firms, and in the economy. In contrast to the user-led innovation studies, open innovation from the producer-focused approach means the purposive activity of the producer to channel in external resources in order to raise its capacities for innovation. Even if talking about collaborative forms of production, this model focuses on the role of the producer handling the spillovers of innovation and creation of new markets. The firm thus, [re]organizes itself in order to meet the challenges of cooperation. For understanding this process herewith I refer to Chesbrough's definition [2006] of open innovation, which has become a starting point for numerous scholars. Open innovation works at two levels, as:

1] the purposive inflow and outflow of knowledge:

- to accelerate internal innovation: thus to enhance technology,
- to expand the markets for external use of innovation.

2] a business model for firms

- to rearrange their innovation process and **organizational setup**, and
- to gain from the wasted spillovers and intellectual property.

The flow of knowledge thus serves as a tool for boosting technological advancement, more precisely technological innovation in its Schumpeterian understanding [1934]. In Chesbrough's understanding market serves as a place for the ideas of the firm, which used to be protected by intellectual property: "the use of internal and external paths to market serve to advance technology" [Chesbrough 2006, p. 1.] It is

DOI: 10.14267/phd.2016007

related to the Schumpeterian non-technological innovation in a limited sense of exploiting and extending the paths to the market, although strictly said it is not focusing on the activities aiming specifically at developing those new markets.

Chesbrough [2006, especially 2011] stresses the role of transformation of firms in their organizational setting in order to follow the suggested and elaborated business model of open innovation as an adaptation mechanism to gain comparative advantage over the others in competition. The suggested frame considers the rearrangement of the functions and departments within the organization, but the perspective of fine-tuned adaptation of routines and capacities of the firm play little role in his investigations.

Open innovation represents a shift from vertical arrangement of the innovation activity of a firm. It is a transformation of how firms use and manage their intellectual property, stretching the knowledge-based conceptualizing of the boundaries of a firm. With opening up the knowledge outflow and the gained knowledge through forms of collaboration, firms do not possess them in intellectual property schemes, but provide other players that knowledge. The producer-model of open innovation is a concept relying on the permeability of a firm [Baldwin and von Hippel 2011].

C) Open Innovation Over Networks

Scrutinizing networks for design and innovation as unit of analysis, allows for investigations on 1. cooperation of firms, 2. knowledge-share, 3. reshaping the boundaries of firms. The focus thus shifts from the focal firm to networks.

1. *Cooperation*. Firms team up in order to create networks for open innovation [Chesbrough et al 2006]. The locus of innovation might defer according to the center-based activities of firms. Within inter-organizational nets firms are not only embedded through their ties, but they turn out to be parts of regionally nested clusters representing

DOI: 10.14267/phd.2016007

subsystems of regional/ national innovation systems. It is also documented that agricultural firms arrange themselves complementing each other in order to create value for specific targets [about value networks Vanhaverbeke 2006]. Scholarship on production and co-creation over networks of firms focusing on the cooperation among agents, meets policy needs to understand determinants like *entrepreneurial attitude, cooperation and connectivity of firms* [Barge-Gil 2010].

2. *Knowledge-share*. Networks represent source for innovation over firms and partnerships and as such, serve as configurations for knowledge transfers [loose coupling: Brusoni 2001]. It is documented that interactions of organizations in a hierarchical/ vertical network allow for a combination of new capabilities in order to develop new products [for eg. architecture of transaction networks in two sectors, Luo et al. 2012]. In the realm of knowledge-based approach, one can find that open innovation is the fusion of previously separated knowledge [technologies] by the new relations involving users, consumers, firms with different specializations and competences, and non-firm organizations [Malerba 2005]. However, there are concerns with the imperfect overlap of knowledge and production boundaries in networks of firms [Brusoni 2001]. Simard and West by exploring knowledge networks, construct a classification based on the characterisitics of formal/ informal deep/ wide nature of interfirm ties defining the locus and enabling open innovation [2006, p. 235].

3. *Networks reshape boundaries of the firm*. Networks of firms in studies on knowledge-creation and dissemination within projects seem to concentrate on inter-organizational ties, although project-based organizing involves organizational and personal networks as well. The locus of production, knowledge-share and creation spanning boundaries of firms, and organized around tasks are called epistemic communities [Grabher 2004]. Furthermore, Grabher [2004] argues that that the firm still represents a stable and unquestionable unit in the study of project-based work. In answer to Grabher's argument, scholarship on creative industries stretches the role of projects and the formation of project-based

DOI: 10.14267/phd.2016007

organizations over networks. These gain from expertise pool, and act for targeted deadlines [Moraga 2006], where urban environment favors face-to-face interaction [Lange et al. 2008]. Flexible organizations and nets of collaborations favored women writers in the film industry [Smith-Doerr 2010]. Projects in the field of cultural industries are investigated with network analysis [Staber 2008]. Sedita [2008] examined the role of interpersonal and inter-organizational networks in supporting economic performance of organizations in the live music industry in the Veneto region. She argues for the presence of a creative network deploying capabilities based on a latent network.

What is clear from this strand is that: 1. networks supply project-based organizational formations, 2. networks of innovation and production stretch the boundaries of firms, where organizational arguments cannot fully explain the behavior of these firms. All shapes of product/ service development stretching firm boundaries ranging from open to user innovation produce forms of collaboration, and can be captured by understanding the production as a web of tasks connected by transactions and transfers, as proposed by Baldwin [2007].

D] Open Collaborative Innovation

User innovations in documented cases receive contribution from others, a community of users, where a typical area of collaboration is the open source software development [Lee and Cole 2003, Baldwin and Clark 2006, Dahlander et al 2008, Harison and Koski 2010]. Consumer-producer interaction and consumer co-creation is an extension of open-innovation, and primarily investigated in the field of web-based technologies, where patterns of digital citizen journalism, digital photography, and online games development [Potts et al 2008, p. 459]. Scholarship beyond the web suggests that collaboration linkages might involve inter-industry dynamics as the documented traits in the fashion and music industry tell us about the role of collaborations of independent producers in order to raise competitiveness [Huage, Hracs 2010], ‘iconic’ brands with artists for cultural projects [Dell’Era 2010]. A further, cognitive-related aspect is that

DOI: 10.14267/phd.2016007

of *collaborative knowledge creation*, which is examined in teams from human resource dynamics approach [Chatenier et al. 2009]. Chatenier et al. find that organizational diversity of the teams raises creativity as well as costs.

What is considered as open collaborative innovation? Scholars seem to rely on different layers of meanings, when they talk about communities of users, open source development, consumer co-creation that might involve the producer, team work of a multi-organizational background, and even linkages between industries for raising profits. Baldwin and von Hippel suggest a narrower framework, in their wording:

"an *open collaborative innovation project* involves contributors who *share* the work of generating a design and reveal the outputs from their individual and collective design efforts openly",

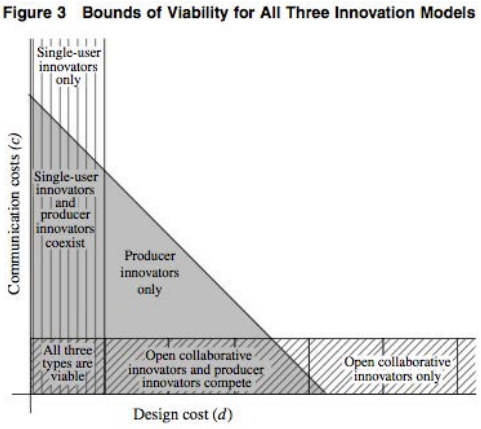
thus: 1. participants are not rivals, 2. they do not individually or collectively plan to sell products or services based on the innovation or the related property rights [2011, p. 1403.]. From this definition we can understand that producer-consumer interaction falls out of scope of analysis, as the producer definitely has the incentive to sell the product. What we are looking at is individual/ collective design what is shared openly for noncommercial purposes, and where intellectual property rights are abandoned, or limited to a minimum. Intellectual property rights over the design and production are believed to bring revenue, if controlled by the producer. Than what are the incentives to participate and share?

For understanding which strategy for innovation is viable [single-user, producer, or open collaborative innovation] Baldwin and von Hippel [2011, p. 1405-6.] suggest a frame based on the design and communication costs. We learn that producers profit depends on the user's willingness to pay, their incentives depend on users valuations. Furthermore producers are affected by the market size for their products, which implies economies of scale as advantage [the same design used multiple times], but results in higher costs of communication [eg. market research], which later can fall due to technological progress. In the open

DOI: 10.14267/phd.2016007

collaborative innovation model users might benefit from the design itself, or the complements increasing the value of design, along with the private benefits [learning, reputation, etc.].

Figure 4 Bounds of Viability for User, Producer and Collaborative Innovation [Following Baldwin and von Hippel, 2011, p. 1408, Figure 3]



Baldwin and von Hippel find that each model is economically viable, and that single user innovations compete with producer innovation due to technological progress: communications costs fall, the capabilities of individual designers enhance, and due to the shift toward modularized and digitized product design and production. As the models compete only in specific situations and areas, producer-driven and single-user innovation models as head-to-head competitors have little possibility of occurrence. Important is that hybrid forms are viable in the case of innovation platforms, as they provide for innovation from different contributors. Baldwin and von Hippel list some examples of closed collaborative innovation where no participant knows what the others are doing except the sponsor [2011. p. 1413].

1.2.3. Summing up: How Open is Innovation?

Following the structural shift toward open forms of providing inflow and outflow of knowledge, along with the problem of intellectual property rights, firms face the dilemma to what extent provide openness. Absorptive capacity, which defines how much a firm can exploit [recognize, assimilate and apply] external knowledge, represents the

DOI: 10.14267/phd.2016007

limitation of opportunities for sourcing in [Cohen and Levinthal 1990]. Absorptive capacity is defined by the prior knowledge, and the size of the firm, tending to provide wider possibilities for larger enterprises, while there is a stronger need for external resources in smaller ones [forthcoming Barge-Gil 2010]. Firms also reveal in order to obtain wider markets for commercializing their innovations to different extent, as it became clear that there are benefits and costs of openness [Dahlander, Gann 2010]. First, it is worth to define what openness actually means lying in between the bipolar notions of open and closed.

A map of differing types of conceptualizing openness in literature, along with a thorough classification of the findings of empirical research on open and user innovation is listed by Dahlander and Gann [2010]. Based on Chesbrough et al [2006], and tackled by van de Vrande et al. [2009] and Chiaroni et al [2011], Dahlander and Gann [2010] work on the two main dimensions of open innovation: 1. inbound or outside-in open innovation, where firms are opening up to external resources "for improving the firm's innovation performance 2. outbound or inside-out open innovation aiming "to commercially exploit innovation opportunities" of firms better-suited to commercialize a given technology [p. 35]. They draw a balance of empirical findings about revealing, selling, sourcing and acquiring resources for innovation, suggesting that benefits and disadvantages of openness play different roles for different firms.

Table 1 Open Innovation [Following Dahlander and Gann, 2010].

Type of openness	**Definition**
Revealing. outbound innovation: non-pecuniary	How internal resources are revealed to the external environment without immediate financial rewards, seeking indirect benefits to the focal firm.

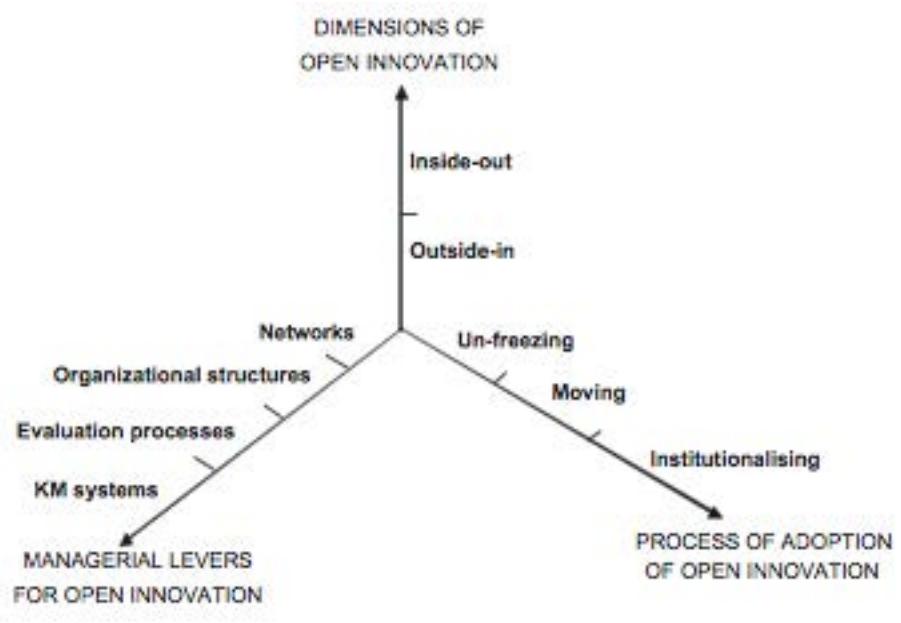
DOI: 10.14267/phd.2016007

Selling. Outbound innovation: pecuniary.	How firms commercialize their inventions and technologies through selling or licensing out resources developed in other organizations.
Sourcing. Inbound innovation: non-pecuniary.	How firms can use external sources of innovation. Firms scan the environment prior to initiating internal R&D for existing ideas and technologies. If available, firms use them. Accounts of corporate R&D labs are vehicles for absorbing external ideas and mechanisms to assess, internalize and make them fit with internal processes.
Acquiring. Inbound innovation: Pecuniary.	Firms acquire input to the innovation process through the market place. Openness here is how firms license-in and acquire expertise from outside.

Following the path to look at the different shades of openness, Chiaroni et al [2011] channel in the managerial levers of open innovation to the adoption process of the organization. They provide with a thorough illustration of the opening up process with the case of Italcementi. They conclude on tapping the radical organizational rearrangement backed by the commitment of the top management to innovation.

DOI: 10.14267/phd.2016007

Table 2 Dimensions, Adoption, and Managerial Levers of Open Innovation [Adopted from Chiaroni et al, 2011, p. 36: Theoretical framework].



As a further attempt to break with the binary open-closed understanding, and focusing on the procedural nature of innovation, an important contribution in the categorization of degree of openness is made by Barge-Gil [2010]. The continuity of open innovation is described by three stages of: open, semi-open and closed open innovation. Barge-Gil adds to the absorptive capacity argument about openness [the more absorptive capacity a firm has, the more it can profit from open innovation], the 'need effect' of a firm for openness based on its size and R&D volume. The need effect goes against absorptive capacity, thus the bigger a firm in size and R&D the more it is capable to absorb, but the less it needs it: these firms chose semi-openness, where the core of their innovation process is kept in-house. In the middle of the two contradictory forces stands open innovation with middle-sized firms. The smallest ones with the lowest absorptive capacity and strongest need for external resources represent the non-cooperating [closed] strategy. The three categories were defined as follows:

DOI: 10.14267/phd.2016007

Table 3 Open Innovation Strategies [Following Barge-Gil, 2010: 586-7].

Innovation	**Strategy**	**Information sources**
Open innovators	innovate mainly through collaboration with other entities or mainly by others	At least one external source is more important than the internal knowledge
Semi-open innovators	innovate through in-house efforts, but having cooperated or bought external R&D	The most important external source is as important as the internal knowledge
Closed innovators	innovate in-house, with no cooperation or external R&D	The most important external source is less important than the internal knowledge.

In contrast to the above-exposed producer-driven models of open innovation as a process, referring to the different levels of organizational permeability, Baldwin and von Hippel [2011] argue for a different use of the concept. While "openness" is used widely as obtaining new ideas, patents, etc. from outside of the firm following Chesbrough's model [2006], Baldwin and von Hippel understand open innovation when all related information is a public good [p. 1400]. This understanding of "openness", as pointed out by the authors, is backed by contemporary empirical findings of user innovation research, investigations on open source, open science solutions, as well as historical descriptions with examples dating back to the 19th century. Firms as well as individuals freely and voluntarily giving up their property rights reveal their developed innovations, for gaining benefit from further development of their ideas by others, network effects, or enhancing reputation.

DOI: 10.14267/phd.2016007

1.2.4. Transaction Costs of Openness

Following the institutionalist approach of transaction costs economics one might think that opening up reconfigures what is meant by costs of using the market, negotiating, coordination, control of property rights or contracting. The incentives for firms to open up for innovation and production might stem from the lowering costs related to establishing links, rearrangement of the industry, technological advancement or policy affecting institutions [eg. property rights]. I do not intend to provide here with a thorough analysis, rather to give a brief list of the transaction costs that might play and that shall be considered in further research on, viable forms emerging, and for policy-making when creating a fertile environment for firms to open up.

A typical coordination problem is the vertical vs. horizontal integration within a firm or industry. When firms shift their innovation and production activity toward horizontal arrangements and partnerships, thus they start collaborating with external partners, then according to Grant [1996 through Dahlander and Gann 2010] the following costs are affected:

1. *costs of coordination*: emerging from different organizations. It is difficult to bridge organizational boundaries, where there are too many relationships, it might impose the diversion of managerial attention.
2. *costs of competition*: emerge from risk of opportunistic behavior, where protection of intellectual property rights might impose extra costs.

In extending the partnership for innovation from the perspective of capacities, Langlois [1992] draws the attention to the presence of *dynamic transaction costs*, which are:

1. costs related to negotiating, persuading and teaching potential partners with valuable resources
2. costs related to those lacking resources when in need.

DOI: 10.14267/phd.2016007

On the other hand though, raising capacities might pay off in the long run, as *absorptive capacity* "reduces the costs of openness by reducing search and assimilation costs, and increases profits by its better application to in-house activities" [Barge-Gil 2010, p. 580].

Innovation itself, in its classic Schumpeterian producer-driven understanding, has its transaction costs. The assumption here is that innovation pays off, if the producer can profit from the use of its design for a period of time, protected by intellectual property rights. Baldwin, von Hippel [2011, p. 1409] specify the related transaction costs of innovation, as which include:

1. costs of establishing exclusive rights over the design [secrecy, and obtaining patent].
2. costs of protecting the design from theft: restricting access, enforcing noncompete agreements
3. legally transferring rights for the good/ service, and receiving compensation, protecting both sides against opportunism.

As a response single-user innovators might hide some of their innovations to economize on costs. In the case of open collaborative innovation: there are no above-mentioned transaction costs, as they do not sell products nor pay the contributors. They warn though, that in large projects protection might occur, where hierarchical arrangements come to forth for eg. to provide access not to change the master copy [in software development]. Furthermore Baldwin and von Hippel [2011] add that regulation is a transaction cost imposed by the government on all types [producer, single-user, open collaborative] of innovation.

1.2.5. Where Does Open Innovation Take Place?

Innovation can be understood as the elaboration of a set of rules for new design of products, or solutions to problems. Considering the numerous players involved in both innovation and production, it might seem ambiguous to locate where exactly the elaboration of these new design rules or solutions come from. Following the different strands of

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scholarship, one might spot the shift of the locus of innovation in different approaches. It is important to define the locus of innovation as it shapes the analytical perspective of analysis.

In von Hippel's studies [1976, 1988] for example, the locus of innovation can be the manufacturer or the user, or even sometimes the supplier. In contrast Chesbrough [2006] relies on the producer as the core locus for innovation, where attracted external resources serve as complementary contributions to the new solutions. But how to locate innovation where emerging teams or groups provide the dynamics for collaborative forms of cooperative work? Locus in these cases shifts to a community of innovators performing group dynamics and situated co-creation. Studies reveal that this gains importance specifically in fields where creative work is related to a less rigid organizational structure. Smaller, flexible firms need less effort for restructuring [moving less human resource capacities, and organizational structures, departments], thus might assign for looser cooperative structures. Beyond the borders of the firm, powerful locus for innovation can be found in the co-creative work of online communities [Dahlander et al. 2008, Lee and Cole 2003 on Linux Kernel development]. Apart form the interpersonal and organizational perspectives the geographical locus of open innovation might explain the embeddedness into regional/national systems of innovation [Simard and West 2006].

1.2.6. Open Innovation in Empirical Research

Research on open innovation was firstly overwhelmingly conducted in technology related industries ranging from chemicals, thermoplastics, medical devices to lubricants and aerospace, etc. Chesbrough and Crowther [2006] based on a survey found that adapted open innovation rather tends to complement than substitute of internal R&D activities, and open innovation is adapted beyond high-tech.

The volume of research investigating relationship between innovation and firm size, and innovation and market structure is very impressive [van de Vrande et al 2009, Dahlander et al 2010, overview Gassmann et al 2009]. This stream of research contributes to understanding a static picture of

DOI: 10.14267/phd.2016007

firms and innovation, and does not allow for a dynamic view of the industry, the interaction and transformation of industries within an economy. These analyses are backed among others by the available and constantly improved databases, some of them including questions aiming at modeling forms of cooperation and organizational innovation [for eg. Wynarczyk et al. 2013, Hall et al. 2009, deMassis et al. 2012]. There are studies on linking product and process [open] innovation through value chains [Theyel 2012]. We learn that micro and SME firms tend to interact with R&D research centers enabling them for the role of catalysts of open innovation [Roper and Hewitt-Dundas 2012]. Some apply the frame of social capital to understand inter-organizational collaborations in open innovation adapted by SMEs [Padilla-Mélendez et al 2012]. The relationship between the sector and openness is not yet clear in literature, although there is a research bias toward the high-tech sector [Barge-Gil 2010].

There are empirical findings documented of users innovating for in-house use [Pavitt 1984] in low-tech [Herstatt and von Hippel 1992], in sports in different communities [Franke and Shah 2003], or kite-surfing [Tietz et al. 2005] or about the need for local information as economic incentive for mountain biker's innovation [Luthje, Herstatt and von Hippel 2002]. Morrison, Roberts and Midgley [2004] constructed the leading edge status [LES] to describe users, and found that users with a high level of this variable tend to predict and accelerate early product adoption.

As mentioned earlier a number of scholars have examined open innovation in the context of open source, and creative collaboration in online communities: about Finnish software producers [Harison and Koski 2010], and open source development [Lee and Cole 2003, Baldwin and Clark 2006, Dahlander et al. 2008, Harison and Koski 2010]. These studies tackle the incentives to share knowledge and inventions, and the relation of producer and user in open forms of co-creation. Knowledge transfer in open source development is explained by the role of social capital [Méndez-Durón and García 2009].

DOI: 10.14267/phd.2016007

The service sector as the main driver of the advanced economies gained focus in the innovation literature. This scholarship considers the structural change of the economy connecting it to the tradition of macro approach to innovation. The significance of nontangible knowledge-intensive services and the knowledge-intensive business sector is gaining comparative advantage on a global scale, as articulated by the contributors to this research realm [Chesbrough 2011, von Hippel 1992, etc.]. Users are found to be active in this field as well. A study of the banking sector suggests that users are active to innovate nearly in half of the cases in the computerized banking services and retail services earlier than banks offered to them [Oliviera and von Hippel 1992].

Chesbrough [2011] dedicates his studies to the knowledge-intense services as the considered escape route from the commodity trap and solution for growth. He considers product-focused innovation an outdated conception of innovation to stay on the market, and suggests building platforms to attract further companies. He argues that open service innovation is an approach toward complexity of production and supply, where the customer's knowledge and experience is channeled in as well. Furthermore he provides tips on the organizational matter: how firms should redefine their routines and structures to be able to transform.

Organizational flexibility, and the importance of inter-organizational and inter-personal networks, and interactions in open forms of innovation and production of nontangible goods and services in the creative industries and cultural production has gained the raising interest of scholars [Potts et al 2008, Huage and Hracs 2010, Dell'Era 2010]. Here organizational diversity and the project-based form of collaborations stretching firm boundaries are at stake. Networks of interpersonal ties, inter-organizational arrangements and tasks of production and innovation might overlap but they are not the same. There is still work to be done on this matter, based on the findings of open source projects, and/ or the theoretical approach proposed by Baldwin and von Hippel about open collaborative innovation [2011].

DOI: 10.14267/phd.2016007

1.2.7. Conclusions

Nonetheless the producer model of open innovation was suggested as a new paradigm for production arrangements of firms [Chesbrough 2006, 2011], von Hippel [1976, 1988, 2005] stresses the importance of single-user, user firm, or lead-user generated product or service development in meeting the firm's production line. Open innovation spans networks of firms, where schemes of cooperation, and knowledge-share are at focus, and especially in cases of frequent changes and project-based activities boundaries of firms urge to be revisited by scholars. It seems that due to the transformation of industries and markets, the lowering communication costs, and increasing role of platforms and modular design of production open collaborative innovation leads toward a paradigm shift [Baldwin and von Hippel 2011].

In the current overview I have gone through the growing scholarship on open innovation, grouping it into four broad categories or models of investigation [1. user model, 2. producer model, 3. open innovation over networks and 4. open collaborative innovation]. I have summarized models tackling the different shades of meaning of openness, which ranged from the binary models of open/ closed, toward more procedural models including further stages and characteristics, ending up with the public good's perspective defined by the elimination of property rights.

Further, I have pointed out to the relevance of the transaction costs related to establishing links, rearrangement of the industry, technological advancement or policy affecting institutions in understanding the viable forms of [open] innovation strategies of firms. It is not less important to define the locus of innovation for further analyses of different firm and interaction level formations. Finally, to illustrate the arguments and some of the conclusions, I draw on some examples deriving from various fields of empirical investigations. What I find as most important challenge for further research is to broaden the scholarship on open collaborative innovation toward fields beyond open source development, and revisiting the boundaries of firms in networks of innovation and production

DOI: 10.14267/phd.2016007

involving interpersonal as well as inter-organizational ties. Modularity, Innovation and Open Innovation

Now, let me bind the above frames of modularity and open innovation in the next section. The path suggests to explain first the relation of modularity and innovation.

DOI: 10.14267/phd.2016007

1.3. Modularity and Innovation

Modularity is an effective repartitioning of a product, production system or organization in order to reduce costs, boost innovation and raise effectiveness. Henderson and Clark [1990] challenged the traditional approach of incremental and radical innovation by suggesting that innovation can be achieved without changing the components [architectural], challenging the knowledge of established firms. A further achievement of Henderson and Clark's study is that it conceptualizes innovation types [radical, incremental, modular, architectural] illustrated with vivid examples and empirical cases from the semiconductor sector based on the relationship of the components to structure.

As said before, Henderson and Clark's frame describes industrial production, focusing on the role of architectural innovation. To recall here, architecture is how the components are combined together, "how the components will work together", while a component is "a physically distinct portion of the product that embodies the core design concept", [Henderson and Clark 1990, p. 2] and a core design concept is the technological characteristic of the component.

Table 4 Following Henderson and Clark, 1990, p. 3., Fig. 1. ["A framework for defining innovation"]

	Core Concepts	
	Reinforced	**Overturned**
Unchanged	Incremental Innovation	Modular Innovation
Changed	Architectural Innovation	Radical Innovation

DOI: 10.14267/phd.2016007

Architectural innovation leaves the core design concepts untouched, while modular innovation changes the core design concepts of technology, like the switch from analogue to digital dialing device on the telephones. A slight modification of a component, for e.g. the size often triggers modifications in the linkages, thus architectural innovation linking the components together in a new way.

It is worth to note that different types of innovation require different organizational capabilities, and that no clear types exist when coming to practice. The impact of the novelty varies according to the angle we view it from. Some products might bring systemic change for the whole industry, while others represent radical novelty for a subsector of an industry, or a radical switch for the company itself. The interpretation of radical, incremental, architectural, and modular innovation is somewhat fluid. Still, Henderson and Clark provide some aspects to consider. Below, I summarize the main characteristics of the above forms of how producers innovate mining out the possibilities of modularization.

Radical innovation:

- shifts the industry/ branches of industry/ the company/s production/ innovation practices
- opens new markets
- implies switching costs
- core concepts of product design are changed
- might be systemic in the sense architecture and core concepts changed
- it creates difficulties for established firms, as it is based on a different set of technical principles
- radical innovation often establishes a dominant design which is followed by competitors, and by improvements [incremental innovation].

DOI: 10.14267/phd.2016007

Incremental:

- adjusts, refines the product/ product-line/ technology due to improvements
- it also creates followers, a set of competitors
- the refinement/ improvement of the product creates comparative advantage
- core concepts are not changed
- exploits the potential of established design
- reinforces the dominance of established firms

Modular innovation

- core concepts do not change
- architecture do not change
- has costs and benefits as seen above at modularity

Within the next chapters of this book I will analyze different cases relying on the above-sketched framework.

1.3.1. Open Innovation, Open Collaboration and Modularity

Modules create opportunities to enter the design of a product. For definitions of open innovation, user innovation and open collaborative project see chapter [previous sections of this chapter, and my paper Faludi, 2014]. Division of labor contributes to arrange the permeability of the firm. Modularizing the production process allows for different forms of collaboration: outsourcing, loose coupling, work over networks of firms, etc. Scholarship on the entry points for opening up innovation and how modularity contributes to openness can be grouped along the following topics:

A) Open innovation over networks of firms and modularity,

B) Intellectual division of labor and open-source development,

DOI: 10.14267/phd.2016007

C) open collaborative innovation and modularity,

D) Platforms of innovation and modularity.

A) Open innovation over networks of firms and modularity

Modularization creates a centralized or decentralized network of firms, where modular design of the product itself is not seen as an ‘ultimate entity’ but a bundle with the consumer’s preferred combination of attributes [Langlois and Robertson 1991, p. 298]. Within this network, where the product is modularized, the specific attributes represented by a supplier, might vary. Suppliers thus enter innovation through developing on the attributes they produce for the product. Suppliers might contribute to innovation in two ways: initiated by the producer, or suggesting developed solutions based on their knowledge of the components [see forthcoming Chapter on Valcucine]. Modularization can create an architecture where complementors of the product are produced by suppliers, or other contributors [see the following argument below heading to open collaborative projects].

B) Intellectual division of labor and open-source development, open collaborative innovation and modularity

Producers by modularization of the product can create an architecture in such a way, where large components are produced by the producer, and a number of small components is developed by other contributors, for e.g. single-users, or collaborators if opening up the design [Baldwin, von Hippel 2011, p. 1413]. Contributors in these schemes are incentivised by the outcome that becomes a public good. Modularization and a specialized division of labor contributes to collaborative work in software development [Langlois and Garzarelli 2008].

C) Intellectual division of labor and KIBS providing innovation and design services

Intellectual division of labor is mined out by the knowledge-intensive business service providers in the realm of innovation and design. There are series of companies supplying their knowledge to enterprises lacking of capacities to innovate, or willing to ‘redefine’ their approach to design and innovation [case studies forthcoming in Chapter 2]. When an emergent

DOI: 10.14267/phd.2016007

platform leader cooperates with companies supplying complementary products and services together they form an *ecosystem* of innovation. Ecosystems of innovation raise the value of their innovation, as "more users adopt platforms and complements" [Gawer, Cusumano 2008].

D) Platforms of innovation and modularity

Platforms of innovation created by the producers are vastly studied by scholars [Gawer ed. 2009]. Platform owners economize on owning the platform and entering complementary markets. Products or services are understood as systems of interdependent components being built on platforms [Gawer and Henderson 2007, p. 1.]. Producers might decide on designing and manufacturing the main structure of the product, and invite contributors to innovate on parts of it [forthcoming *Kitchen Becomes Open* in Chapter 2].

DOI: 10.14267/phd.2016007

II Design-Driven Industries

In this chapter I explore the relationship of modularity and innovation through examples grabbed from the broad field of what is referred to design or design-driven industries. First, I highlight some of the approaches to define the field to arrive to my framing of the problem. In this section I also draw on the specificities of definitions in Italian, and through an overview of the field in Italy, where my examples come from. Next, I explore case studies to illustrate the power of the theories at stake [see Chapter 1]. As regards methodology, as I have set it before, the aim was to bring under one frame of analysis very diverse cases in their domain, and nature. Finally, I conclude with a summary of the main findings broadened toward a more general understanding of the 'flow of innovation' embedded into an ecosystem.

2.1. Ecosystem of Innovation. An Overview of the Field

In this chapter I highlight the main actors and interactions of what we can call the ecosystem of innovation for design-driven industries. I rely on a sketchy overview here in order to provide with a context for the specific case studies forthcoming in the next chapters. I focus on the interaction and interrelatedness of industries and how they might affect modularity and innovation. Thus, I do not intend to draw an in-depth picture of the history of Italian design, neglecting the temptation to do so for reasons of consistency of the argumentation of this book.

2.1.1. Design-Driven Industries?

As I grab my cases based on fieldwork in Italy, let me here rely on the definition provided by the Italian Statistical Office's classification of economic activities, the ISTAT Codice ATECO [*classificazione delle attività economiche*], which codes enterprises based on their economic activity. I rely on the overview of Bertola and Maffei [2009, pp. 38-39],

DOI: 10.14267/phd.2016007

based on istat.it statistics, and highlight here the main points of design activity [my translation – F. J.]:

> 70. Enterprise management, and management and marketing related consultancy, marketing strategy, client services, advertising
>
> 71.11 Architecture study, consultancy in architecture, planning and engineering of buildings, town planning, landscape design
>
> 72. Scientific research and development: basic research [experimental not leading to an outcome], applied research, experimental development, work leading to production, development of new materials, products, and appliance, installing new processes, systems and services, or improvement of already produced/ installed products. Within here two categories can be found: natural science and engineering [research and experimental development].
>
> 74.10.1 Fashion design and industrial design activity for products:
>
> - textiles, clothes, shoes, accessories, furniture and other accessories, objects for personal use and home
> - industrial design, all activity ranging from idea to development, and necessary techniques facilitating usage, increase value, raise aesthetic characteristics of products.
>
> Definition of materials, the mechanism of choosing the shape and forms, colors, and the external finish of the product. Aspects might be: human needs, security, market interest, production efficiency, distribution, usage and maintenance.
>
> 74.10.2. Graphic design activities: advertisement graphics, web pages, illustrations.
>
> 59. Cinema production, video, and television programmes, music and sound recording: film production, video, etc. and advertisement spots on television broadcasting.

DOI: 10.14267/phd.2016007

> 62. Software production, consultancy in IT and related activities. Services in the domain of IT technologies: coding, script, modification, verification and assistance in software design, planning and development of information systems integrating hardware, software and communication technologies, on-site management and use of client systems, and data development, etc.

As we can see from the above list the range is broad, it embraces branches from architecture to software development, concentrating on research, development, improvement and consultancy activities with regards to tangible, nontangible products and services. My examples will not cover all the fields, but still bring a colorful illustration to the main question at stake: the relation of innovation and modularity.

Scholars have tackled how the different aspects of design activity is interpreted through interaction stretching the cultural and social dimensions, or usability [Power 2002].

The approach of ISTAT above covers activities under the notion of *design*. But what about the notion of *design-driven* industries, how to define industries that are more to that: they are *driven* by *design* or *intensive* in *design*? Let me address this question with a further suggestion, that is to break down industries to those that are design-intensive, and as such show differing characteristics in their production of meanings. This semantic approach to production is reflected in scholarship on creative industries [Caves 2000 on the role of stylistic innovation over technological]. About design from Dell'Era and Verganti [2010, p. 125] we know that:

> "In design-intensive industries, the diffusion and success of product signs and meanings are influenced by phenomena emerging in society and depend on interactions between several stakeholders: users, companies, products, media, cultural centres, schools and artists."

Deriving from this definition the content of design is: signs and meanings. This approach puts the content of 'functional' to the background. This

DOI: 10.14267/phd.2016007

implies that products are constructed in a way to convey the meanings read and valued by the public [I extend it to the wider public from consumers in the strict sense being aware of the socio-cultural embeddedness of these meanings]. Moreover, Dell'Era and Verganti also point out the significance of design in innovation activities of firms. I will explore further aspects of value creation later in this chapter.

2.1.2. The Ecosystem

An ecosystem consists of populations, living economic actors, and physical components [eg. facilities, infrastructure]. Boudreau and Hagiu [2009] suggest to view a business ecosystem "as a collection of [many] firms engaged in joint production, whose choices and actions are interdependent". In addition to that, we know, that innovation can be stimulated by an ecosystem of competitors and complementers [Simon 1962, Ulrich 95, Baldwin and Clark 2000, through Woodard and Clemons 2013]. I rely on the notion of ecosystem to understand the interaction and interdependency of the industries. Moreover, the framework of ecosystems explains modular arrangement in production [Gawer 2009]. In order to understand how innovation flows across industries, meanings and technology, one needs to see the main points of interaction an ecosystem provides with. Let me list here the main players and institutions of Italian design without the intention of completeness.

2.1.3. Players and Shapers of the Discourse on [Architecture and] Design

It is obvious that producers of artifacts need to sell their products. If there is a number of producers, they might 1. organize the market, 2. form platforms. As I am focusing on production in this work, I am not drawing on consumers, rather the strategies of the players to introduce consumers/ users into the discourse on design or even to innovation.

DOI: 10.14267/phd.2016007

Producers are those, who benefit from designing, producing and selling the product. Producers show great variability ranging from self-, small, medium, to large ones. At one end of the range I refer to the establishment as those with a longer history of [at least a decade of] tradition and production. *Self-producers* stand on the other end, designing, organizing production and selling of their products by themselves [about the role of designers forthcoming]. Companies vary in their strategies of development, production and vending. However, one of the common patterns is a net of suppliers operating overwhelmingly in these tasks, while the 'enterprise' concentrates on the branding of the products. Here 'design' itself is reduced to the enforcement and representation of 'core design concepts' being part of the brand [see Chapter on Valcucine case study forthcoming].

Retailers offer a range of services apart from selling the products, and showcasing them. They suggest life-like arrangements to appeal to customers, provide with services in interior design of homes, apartments, offices and public spaces. Companies, thus producers might have brand-stores, but apart of them, or even instead they might rely on retailers to commercialize their products. Retailers thus have a crucial role in direct communication with the customers, understanding and answering their needs.

Platforms are defined as competing products and complementers [Gawer 2009]. Large enterprises in the furniture industry, for example represent a platform for other industries. For eg. a kitchen needs: lights, cutlery, machinery, etc… With predefined standards, and contributing suppliers these platforms can be open or closed [Gawer and Cusumano 2008, Gawer and Henderson 2007]. They might be surrounded by an ecosystem of competitors and manufacturers.

The main players of Knowledge Production are the Higher Education Institutions, as well as different courses, and [post-graduate] trainings in design. In Italy primarily it was in the domain of architecture, from which

DOI: 10.14267/phd.2016007

industrial design has evolved as a disciple. It was not until the mid-eighties that academic training was organized backed by research.

Now let us turn toward the institutions that needed to be established in order to organize the market. We know, that with the rise of new industries the market is organized by the producers from the computer industry [Baldwin and Clark 2000, p. 105]:

> "Venture capitalists joined forces with computer designers and entrepreneurs to organize new firms making new artifacts and new markets to supply and exchange new computer products."

Now, the market for interior design and related industries: furniture, appliance, etc. was organized in Italy during a couple of decades with the initiative of designer-architects and entrepreneurs. Starting from the postwar period after WWI, underpinned by the technological advancement and experimentation after WWII, it brought its internationally valued flowers in the sixties-seventies. The postwar decades have met the challenge of reorganizing the Italian economy. The creation and promotion of products of Made in Italy was an important driver for manufacturers to be supplied to external as well as widening internal markets. Made in Italy is a concept for branding Italian products, where stereotypes attached to the 'styling' or 'design' played an important role through out history [Antonelli 2002]. For creating and establishing the discourse shaping on what the 'brand' [of Made in Italy] would constitute of a number of fruitful initiatives were taken. Here I highlight just the main institutions in this line.

We know from the history of design and architecture, that interior arrangement of a home went hand in hand with an integral concept of planning, developing at the first half of the previous century. The first, and even later many of successful 'designers' were architects. Design education encompassing a range of different disciplines was organized later, starting from the eighties-nineties [Bertola and Maffei 2009]. Getting back to the times when the main institutions were set, one will notice the key role of architects [among them Gio Ponti and Alberto

DOI: 10.14267/phd.2016007

Rosselli] in setting the frame for discourse on design. Now, here is a list of the main platforms for shaping the narratives about design, and indirectly contributing to creation of value, awards, events, magazines, museums, and the world of academia and education.

Association for Industrial Design[2] [Associazione per il disegno industriale [ADI]]

Initiated by Gio Ponti [and co-funded by Alberto Roselli], ADI is a syndicate bringing together manufacturers, designers, researchers, academics, editors, journalists in order to create a shared platform to promote [industrial] design in Italy. As such, it is the most important institution in shaping the discourse. Today, ADI is a member of ICSID International Council of Societies of Industrial Design, and BEDA, Bureau of European Design Associations, ICOGRADA International Council of Graphic Design Associations. ADI features a series of awards [Compasso d'Oro, ADI Design Index, Compasso d'Oro International Awards]. In this series the ADI Design Index encompasses products in the following categories: design for living, person, mobility, work, and materials and technological systems.

Awards

Triennale Award was taken over by ADI. ADI is sustained by enterprises, with a membership of editors and designers, which might imply difficulties and obstacles for structural tectonic change of the field from this part.

Compasso d'Oro. To reinforce Made in Italy and promote Italian design in furniture production, Gio Ponti initiated the Compasso d'Oro [1954] award backed by companies, like Finmeccanica, Olivetti, Pirelli, Motom, Necchi, Borletti, Cassina, Rinascente [which is a large retailer in fashion

[2] http://www.adi-design.org/about-us.html

DOI: 10.14267/phd.2016007

and home décor]. The award is given every three years. From 2015 an international award was initiated [in the topic of Food Design].

Prime for Innovation [Premio d'innovazione]: Design Index, Prime of Primes [Premio dei Premi [per l'innovazione]]

Triennale di Milano [3]was founded first in 1923 in Monza for exhibiting the inventions in applied arts and technology of the time. It was moved to Milan a decade later in 1933. [Most interesting project was the showcase house, *Casa Elettrica* installed in 1930, by a group of architects: Figini, Pollini, Bottoni, Frette, Libera in Monza for the IV. Triennale [about *Casa Elettrica* see Chapter on Valcucine and kitchen design]. The objectives of Triennale di Milano were to link applied arts, industry and production, and it has become point of reference[4] for industrial design hosting the events of Compasso d'Oro [see above]. Since 2007, within Triennale was established the Triennale Design Museum, which is the curator and host for exhibitions, events, and archive of the past and present of Italian architecture and industrial design. The Triennale Foundation is sustained by the Ministry for Culture and Cultural Heritage of Italy, Region of Lombardia, Municipality of Milan, Chamber of Commerce of Milan, Chamber of Commerce of Monza Brianza.

Fiera del Mobile di Milano is an international event for exhibiting the novelties in living design. It was first organized in 1961, and since it has seen numerous editions, and events created on the basis of it as a complementary event. There are thematic events, like the Cucina [see chapter on Valcucine 1.], or a 'fringe' event, the Fuori Salone which encompasses the experimental approach to design [see more in chapter Valcucine 2. and Malossi 2009]. An important historical event in the international branding of Italian products of living was the exhibition titled *Italy: the New Domestic Landscape*, held in New York in 1972 at the

[3] http://www.triennale.org/it/istituzione/fondazione-la-triennale-di-milano
[4] http://it.wikipedia.org/wiki/Triennale_di_Milano

DOI: 10.14267/phd.2016007

Museum of Modern Art, curated by architect, Emilio Ambasz [projects of Gae Aulenti, Marco Zanuso, Richard Sapper, Mario Bellini, Alberto Rosselli, Ettore Sottsas, Joe Colombo were displayed] [Antonelli 2002].

Magazines

Domus was established by Gio Ponti in 1928, focusing on architecture, art and design. Stile magazine created by Ponti during the war in 1941-1947, encompassing art and architecture. Domus, *Abitare*, *Casabella* were important milestones in creating the Made in Italy [Antonelli, p. 22-38]. *Stile Industria*[5] founded by architect Alberto Roselli in the year of first Compasso d'Oro [1954]. Stile Industria was a counterpart to *Domus* and an important platform for Roselli to share his visions about architecture, design and *stile italiano [Italian style]*. During its life of a decade [seized in 1963] *Stile Industria* set the goal to establish professional and readable magazine for the wider public discourse on industrial design in Italy. Further important editions on design are *Modo, Disegno, Bravacasa*, etc.

Museums play a large role in creating the 'story' and the legends of design, reflecting the enterprises and the 'star' designers production. Narration about design takes place in magazines/ journals and museums as well.

The Historic Collection of the Compasso d'Oro Award [Collezione Storica del Premio Compasso d'Oro ADI [maintained by the ADI Fondation].

Enterprise Museums [Museimpresa]

Museimpresa covers a net of museums established and maintained by large, medium and small enterprises in Italy, which present their industrial heritage to the public. They also maintain large archives and guided tours along the themes of history of design and enterprise, innovation and key

[5] http://www.italianways.com/stile-industria-creativita-e-produzione/ http://www.thisisdisplay.org/tag/Stile+Industria

DOI: 10.14267/phd.2016007

figures. Some examples: Alessi, Kartell, MUMAC [Cimballi], Campari, Martini e Rossi, Poltrona Frau, Olivetti, etc.

Design Museums and Collections play a crucial role in the canonization of design artifacts, and creation of a design history. Moreover these artifacts enter the realm of artistic valuing. As an illustration, the products of Arflex now considered as 'classics' of design are exposed world-widely for e.g. here:

- MoMa di New York [Gaia, Lady]
- Permanent collection of the Chicago Athenaeum [Dune]
- Triennale di Milano [Fiorenza, Martingala, Strips, Delfino, Boborelax, Lady, Antropus, Bicia]
- Triennale di Tokyo Museo permanente [Lady, Fiorenza]
- Museum of Contemporary Furniture in Ravenna [Museo dell'arredo contemporaneo di Ravenna]: *Lady, Martingala, Fiorenza, Antropus, Tripoltrona, T-line, Felix, Privè, O-line, Triennale, Strips, Bicia*.

Universities, Design Schools

Knowledge-production in the post-graduate and higher education is also underpinned by academic research. In Italy there are 16 universities in design, 4 Colleges [Istituti superiori per le industrie artistiche ISIA] [Bertoli and Maffei 2009. p. 32], and there are 14 doctoral programmes in 9 universities on design [p. 31]. The largest number of researchers, and research projects can be found in the North of Italy [Milan 219 research projects/ 64 researcher, Torino 27/7, Genova 33/6, Firenze 35/11, while in Rome 14/5, Naples 10/5 [Bertoli and Maffei 2009, p. 70-71]. Focusing on the content of the areas studied within design, doctoral programs cover: 29% product design, 30% environment [interior and external], 18% communication and interaction design, 14% strategic design, services to complex systems, 7% material and components, 59,5% instrumental research [ibidem p. 47].

DOI: 10.14267/phd.2016007

IVREA Interaction Design Institute[6] was an important project for experimentation, innovation and interaction design. I draw on Ivrea here, as it produced a totally new generation of designers and start-ups shaping the field today, being the very first place to teach interactive design. Ivrea was the initiative of Olivetti and Telecom Italia, and proved to be short-lived [2001-2005].

The implications of the digital turn in our lives, is on one hand, the replacement of the discourse to the digital realm in the form of

1. Design reviews, magazines in digital format

2. Blogs, where bloggers become editors and gatekeepers in the information-flow and discourse formation on design and fashion.

3. Social media: which contributes to creating one's own design-review by pinning and sharing content. It is part of the creation of an image, where one doesn't have to invite anyone in their house in order to make a statement of sharing a constructed identity of 'design-consciousness' as a matter of signaling.

KIBS [Knowledge-Intensive Business Services]

Enterprises can make use of the services provided by specialized companies in the field of design and innovation and branding. Expertise in research and development of products tailor-shaped to user-needs and those of the client is supplied by companies working with often international or global portfolio of designers, and offering a variety of methodology. In this book I will provide some insight into that through the cases of Continuum and Frog.

2.1.4. From Progettazione Toward Styling, From Disegno to Design

One very important notion to start with is the term *progettazione*, which covers the development of a product/ service incorporating all the activities and domains to make the outcome functional, aesthetic and

[6] http://it.wikipedia.org/wiki/Interaction_Design_Institute_Ivrea

DOI: 10.14267/phd.2016007

appealing to the customer. Derived from *progetto*, thus means a 'product development process from idea to prototype and/or final product' or a 'conceptualized design project'. The term *project* has a broader meaning, and of course the widespread use of it has influenced the semantic spectrum of *progetto*. I refer to *progettazione* as *design process* or *product development*, depending on the context[7].

Styling is a term coined in the United States after the economic crisis of 1929 reared its head. Products featuring no considerable technological or functional advancement had to find their new way for communicating on the market through their look [Mañá 1971: 64-65]. This implies a role of a designer shifting toward the semantic content of the object.

The term *disegnare* covers the activity of putting the concept on paper, where *disegno* is the visualized descriptive of the project. But, *disegno* is more than that according to Roselli, *disegno* is "the resolution factor to a situation" *[*"fattore risolutivo di una situazione" [Koening 1981, p. 62. with reference to Stile Industria, n. 19/1958, p. 1.]. The term *design* reflects the connotation deriving from the *styling* approach to product development, originating from oversees. *Disegno industrial* [industrial design] however, is a translation from English, officially adapted by ADI. One might want to define what the process of and the outcome of development of a product [service] is through understanding the role of the designer.

2.1.5. The Role of the Designer

The role of the designer has changed over time, and if looking from a cross-temporal perspective it is multifaceted according to the type of production. These roles vary accordingly ranging from craftsmanship toward factory production, or from needs of mass-production toward design for small-scale production, or open design. I break it here into six

[7] *Proiettare* is a verb for 'projection of an image', or 'beam', as well as 'pitch' or 'launch'. See more: http://www.treccani.it/enciclopedia/disegno-industriale/

DOI: 10.14267/phd.2016007

categories, that clearly, does not imply that there would not exist further types, moreover these roles might overlap in reality.

1. Designer-Collaborator
2. Designer-Creator
3. Designer-Enterpreneur
4. Designer-Medium
5. Designer-Mediator
6. Designer as Self-Producer
7. Designer-Coordinator

1. Designer as Collaborator

The role of the designer as creating a conception and fine-tuning it in teamwork with the artisans is a role that of the collaborator. When technological knowledge represented by the artisans and manufacturers is channeled into the design process of the product, shaping the initial conception toward one that is manufactured finally. Designers take this role when operating with a larger pool of knowledge sourced in to the design process.

In his article on Olivetti, Stefano Casciani [2014] recalls the self-identification of designer Marcello Nizzoli as a designer who was a "collaborator with the factory technicians" in Roselli's Stile Industria magazine. The role of the designer as collaborator was resolving technical complexity and raising the quality of form and function at the same time in collaboration with the technicians. This concept at the same time implied that the designer was not the "beautifier" of the product [as pointed by Casciani]. In contrast let me remind here the American tradition of a designer as a *stylist* [see earlier in this Chapter]. In the early thirties, industries in the Unites States strived for making their product appealing to the consumer through its style, in case no technical or functional innovation was carried out [Jordi Mañá, 1973. p. 64-65].] In

DOI: 10.14267/phd.2016007

Olivetti's case it is clear that technical innovation went along with a constant search for ergonomic and functional solutions. As an illustration, among the list of equipment for mass production in those times were the first ever printing calculator *Elettrosumma 14* in 1945, designed by Marcello Nizzoli. In 1948 came out *Lexicon 80* the portable typewriter introducing new solutions to improve efficiency and ergonomic interfaces [keyboard and levers], also designed by Nizzoli.

2. Designer as Creator, Design as an Integral System

The designer is the creator, and the main architect bridging meanings into one system. Gio Ponti as an architect not only cared about the building, but he also designed the interior in all its details [furniture, ceramics, glass, etc]. The integrity of the design concept is taken in one hand.

3. Designer-Entrepreneur

A series of examples can be brought form history, where firms emerge bringing into life the concept of an entrepreneur transforming them into products. In this book I refer to the example of Valcucine, where Gabriele Centazzo, founder and manager of the company was the decision-maker in the design concept, enforcing and defining the core design concepts. A further example is the first decades of Kartell, where the founders, Giulio Castelli and Anna Castelli Ferrieri, chemists by their profession, have developed a firm based on plastic and design channeling their entrepreneurial approach to manage the firm, their design and innovation.

4. Designer as a Medium, Cultural Gatekeeper, User-Centered Design

Designers are often seen as mediums converting and using cultural traits and language transforming cultural realities into forms and shapes and colors to make the product appealing for the consumers. Dell'Era and Verganti [2010] found that innovative enterprises in the furniture, home accessories sector maintain large portfolios of designers with diverse backgrounds to ensure diversity represented in the language spoken by the products.

A) Verganti and Dell'Era suggest that designers are cultural

DOI: 10.14267/phd.2016007

gatekeepers, and the have their role in channeling in customer's needs [through the knowledge of socio-cultural meanings] into the innovation process.

B) According to Roselli's argument "the designer had to be the deputy of the consumers in the production process" ["[*Il designer*] doveva essere un deputato dei consumatori presso la produzione." [Koeining 1981, p. 20].

C) In today's discourse on design, user-centeredness is at the core of research and development. KIBS tap exactly to this, by offering a methodology [with extensive role of ethnography] focused on in-depth understanding of behavior patterns and attitudes to be answered by design.

5. Designer as Mediator

This role is close to the above-cited user-centered vision of design. However the example I draw here is less about bringing in line the client enterprises needs with the behavioral understanding of user needs, but rather a complex socio-cultural and geographic understanding of a context inspiring design based on senses. The designer here goes to the field and creates based on the needs of the social, or physical environment. A historical example here is the activity of Paolo Soleri and Arcosanti, where a vision and an experimental city of a project uniting architecture, ecology and landscape was created with the use of traditional techniques mining out the 'collective' imagination back in the seventies[8]. [see the]. Paolo Soleri created his utopistic city with a group of voluntaries in 1970 in Arizona, USA.

[8] Exhibition Austerity and Self-Production, Triennale

DOI: 10.14267/phd.2016007

6. Designer as Self-Producer

The movement of self-production [*autoproduzione*] is pushed by the need to create and produce outside the established enterprises and the ecosystem involved in creating value for the products and related designers. Let me cite here a definition provided by Subalterno1[9] Gallery [Milan]:

> "SUBALTERNO1 considers self-production as a set of activities that include the self-organization of the design process, the construction/production, the promotion and the distribution. All these steps can be executed in different ways but must co-exist to call the process "self-production". Not necessarily the above items have to be made in person by a designer, but when not made directly, they must have at least one person as a customer-organizer."

Photo 1. Subalterno1, November 2014 [photo: J. Faludi]

Technological advancement [3-D printers, laser-cutters, software] has made it easy and lowered the costs of prototyping offering an alternative path for designers to that of the traditional model, designers present their work to the producer who decides on prototyping, developing and

[9] http://www.subalterno1.com/SUBALTERNO-1

DOI: 10.14267/phd.2016007

manufacturing of the product. And there is only one small leap from here toward the makers and designer as contributor to an open project.

7. Designer-Contributor to an Open Project, Designer-Maker

Using the above technologies [laser-cutting, 3-D printing, robotics] lowers the cost of production. Experimentation goes on at least two levels here: 1. how to mine out the possibilities offered by these new technologies, 2. how to improve technology in robotics, electronics and 3-D printing to create further possibilities for production lowering the costs. These communities of makers, digital fabricators [*artigiani digitali*] are served and hosted by Fab Labs creating space for experimentation and knowledge-share. The difference between designer as self-producer and designer-contributor or designer-maker is that the later is not benefiting from commercializing his output. Makers are connected to the philosophy of DIY [do-it-yourself], acting in the realm of industrial design. Designer-makers usually belong to a larger community that might work in one direction, developing a joint project.

Open design and collaboration allow for opening up the outcome accessible for the public. This has at least two implications: 1. no design is lost, as collaborators work on each others projects and reuse ideas and designs, 2. the possibilities for innovation are broadened either by sourcing in more knowledge, or by opening the floor for further solutions.

As an example, the RepRap project [10*replicating rapid prototype*] aims at designing a 3-D printer that can print itself: thus, print its own components, from which a further 3-D printer can be constructed. The project kicked off in 2005 [initiated by Adrien Bowyer] in form of a blog, and now a community has developed around it, providing with model-configurations open-source of course.

Open design covers different approaches, both user-driven or community-

10 http://en.wikipedia.org/wiki/RepRap_Project

DOI: 10.14267/phd.2016007

driven development of hardware/software or other solutions where the result is a public good, and that of commercial use.

7. Designer-Coordinator at the crossroads of Open Design

In projects of open design, where a wider pool of knowledge is sourced in

stemming from designers-contributors with different backgrounds, the design process needs to be coordinated. A crucial point here is to create first a platform on which the concepts can be built on, and second to create a pool of shared meanings. Before switching to the next section tackling the semantic realm of design, let me add here some further aspects to the designer's role, where the designer is a contributor to the product as an architecture of meanings.

Photo 2 At WeMake a FabLab in Milan run by Zoe Romano [Photo: J. Faludi, Nov 2014]

DOI: 10.14267/phd.2016007

Bosoni [2002] discussing about the special characteristics of stile italiano thus the Italian style in design, argues that:

> "the Italian designer is difficult to define homogenously, there are so many and diverse forms of expression and various research is going on. However, a common feature might be that of being a project-oriented and productive figure, in contrast to the engineer in a purely technological sense of approaching only functionality and production." [my translation –J. Faludi].

> "il progettista italiano e una figura difficile da omologare, tante e tali sono le diverse ricerche e forme espressive. Tuttavia mostra un carattere comune nel fatto di essere una figura progettuale e produttiva in antitesi con quella dell'ingegnere, nel senso del puro tecnico che guarda solo alla funzione e alla produzione." [p. 15]

He also points out the role of creative research, and finds that industrial culture derives from a complex regeneration of a rich heritage of craftsmanship [p. 15-20].

Alexander [1964] in his seminal work defines the designer's role as:

"The modern designer relies more and more on his position as an "artist," on catchwords, personal idiom, and intuition- for all these relieve him of some of the burden of decision, and make his cognitive problems manageable. Driven on his own resources, unable to cope with the complicated information he is supposed to organize, he hides his incompetence in a frenzy of artistic individuality."

Who Takes the Decision? Innovation Strategies of Companies

Italian companies are very often described as vertical in their management arrangements. But when it comes to innovation and development of new products, companies vary in their strategy on who takes the decision in the research and development process, which clearly has its effect on the role of the designer. In some cases it is the general manager/ president of the company, in others an appointed art director. The difference lies in the knowledge and capacities in this case. All development projects have their

DOI: 10.14267/phd.2016007

design costs, as well as they bear a preliminary estimation of the possible production costs. In case the information and decision-making capabilities are concentrated in one hand, artistic decisions are taken easier. In other cases it is a matter of negotiations with a board of directors, which path to follow to arrive to a prototype, and finally which prototype is worth of production. Interior designers working in showrooms are very often educated architectures, some agencies channel in their knowledge and experience into the research and development phase [Bersano 2009, p. 53]. Moreover showroom designers are aware of the consumer requests, and gain information on how the brand ‘works’ on the field that they face in their day-to-day work. This strategy of including showroom designers is called cool hunting [Bersano 2009, p. 53]. Many companies rely on Research Centers to tap into branding opportunities. As we will see in the case studies explored in the forthcoming chapters, opening up the process of research and design adds numerous possibilities to source in knowledge and capacities for innovation.

DOI: 10.14267/phd.2016007

2.2. Play the Part: Value Creation and Modular Design for Innovation

2.2.1. The Discourse on Art and Design

I am not willing to enter the discourse on how an artifact produced for let us say sitting on it enters the world of art, that is valued based on the mechanisms valuing a piece of art. Objects created in the realm of the large understanding of ‘design’, for eg pieces of furniture however tend to gain artistic value, if they are produced for small series, or one-piece, a tendency that was describing the late-seventies, and eighties production of living. Mass production was crowded out by the concept of individuality and small-scale as well as in fashion where haute couture flourished, and in living furniture design. Companies shifted from economizing on scale toward scope. Modularization fits well into this rearrangement, as well as the semantic approach toward modularity as I illustrate with case studies in this part of the book.

Clearly, the canonization of historic pieces enriches the narrative discourse on design. As I have argued in the previous section shaping and nurturing the discourse is an important tool for organizing the market. Canonized pieces enter the world of ‘art’, and can serve as a further push for consumption when reentering the production [re-edition of the ‘classics’, for e.g. Zanuso’s gommapiuma-based chair for Cassina, or Up for B&B Italia by Gaetano Pesce].

DOI: 10.14267/phd.2016007

Photo 3 Showroom of B&B Italia with Up by Gaetano Pesce, Milan 2014 [photo: J. Faludi]

DOI: 10.14267/phd.2016007

‘Classics’ of design are important reference points for structuring the narratives both in the production of texts and objects. Stylistic innovation can go hand in hand with, or take the role over technological innovation for new product entries in the creative industries [specifically in [pop] music, toys and games production] according to Caves [2000]. Stylistic innovation might mobilize senses or sentiments and redefine the role and position of the object in its user’s environment as well as lifestyle. Objects designed to be appealing might step out from the realm of aesthetics and search for emotional bonds. In the wider discourse on *stile italiano* for example ‘love’ or sentiment of an object has always played a role [Antonelli 2002, see more Malossi 1999]. A vivid illustration on the conceptual approach to evoke sentiments is the movement of radical design [*disegno radicale]* represented by Superstudio Archizoom that promoted a design that “in its function moves emotions and ideas” [“un design che nella sua funzione si fa veicolo di emozioni e idee” Bergamasco and Croci 2010, p. 31].

To add a further dimension both to the meaning of design and what value creation aims at Dell’Era and Verganti claim that aesthetic, symbolic or emotional meanings of products appeal for customers:

> “Customers are paying increasing attention to product design, whether the *aesthetic, symbolic* or *emotional* meanings of products.” [Dell’Era and Verganti 2010, p. 123].

Alessi is one of the vivid examples on how design appeals to the users by its emotional connotation.

Modularity as a Conceptual Approach

The concept of module or modularity in living and furniture design flourished in the sixties. Functional arrangement of the space, where each block had its own role has been later overcome by the concept of independent pieces of furniture living in the space. Nonetheless modular design has not vanished and has its coming backs and revivals

DOI: 10.14267/phd.2016007

[Bergamasco and Croci 2010, p. 28]. In the next section I explore how modularity enters the semantic realm of objects, and how it relates to production and innovation.

2.2.2. Modular Production and Modular Design for Creating Value

Systems of human symbolic production can be understood as complex systems of interacting elements, with a hierarchy of subsystems, following Simon [1962, 469-470].

Artifacts are also outputs of human symbolic production operating with meanings, however tangible ones. To translate the implication of modularity to objects, I draw on cases from the design-driven industries, namely furniture and kitchen production later in the book [forthcoming in the next Chapters]. I stretch these boundaries toward knowledge production, by drawing on how services in design and innovation can be delivered and transmitted from firm to firm by codified and standardized knowledge and processes.

Apart from mining out the benefits of modularity in production, manufacturers apply modular design of an object or a product [system of objects] to serve further purposes: to create an aesthetic or functional value. Aesthetic or symbolic value conveys meanings to the user, while functionality enhances usability of the product to make it more appealing to the user.

I examine a set of illustrations on value creation through modular design. Here modularity gains a different meaning in symbolic value creation, becoming a core design concept [see forthcoming: the story of kitchen design and modularity in the next Chapter].

The value of modular design here derives from:

- the meaning gained from a conceptual approach to the object
- 'participative meaning' of the object: it invites the user to participate in assembling, deconstructing or adjusting the object.

DOI: 10.14267/phd.2016007

In the first case conceptuality targets the meanings gained through understanding an object through the relation of whole and a part. It implies the stretching of technological solutions, where beauty [aesthetics of the object] and technological feasibility are inter-twinned [examples: the sofa, bed] etc. This meaning is consumed by a layer reading the discourse created around conceptuality. Conceptual approach to creating/ designing objects has an array of concepts domineering the design, where modular design is one of them.

In both cases the user shares the meaning with the producer, where languages of conceptuality and/ or participation are shared. The user's experience can also vary from 'belonging to a community of a shared language, toward a homo ludens experience of accepting to play the game.

Let me here cite some classics of design history to visualize how modularity enters the realm of conceptuality, mining out the interplay of [non]decomposability [Further examples and a more in-depth analysis can be found in the Chapter 2].

To illustrate the concept I cite here two examples: *Kubirolo* designed by Ettore Sottsass in 1967 for Poltrona, and Cub8 designed by Angelo Mangiarotti issued a year later.

The shelving system is made up of elements creating different landscapes depending on positioning. [Photos [11]]. Kubirolo was first entirely decomposable set of shelves.

[11] http://www.compasso-design.it/item_details.php?id=1002872

DOI: 10.14267/phd.2016007

*Photo 4 Kubirolo by Sottsas for Poltrona [source: **http://www.compasso-design.it/item_details.php?id=1002872]***

Modularity as "the essence and spirit of participation" was a concept nurtured by Angelo Mangiarotti ["La modularita come "premessa, essenza ed anima della partecipazione che verra é un principio caro anche ad Angelo Mangiarotti." [Bergamasco and Croci 2010, p. 28], illustrated with Cub8 a multi-shape design issued in 1968. The shelves could be folded into one cube. Cub8 was exposed at the exhibition in New York 1972 at MOMA. [Photo source[12]]

12 http://www.studiomangiarotti.com/gallery.php?tipo=design&pag=6

DOI: 10.14267/phd.2016007

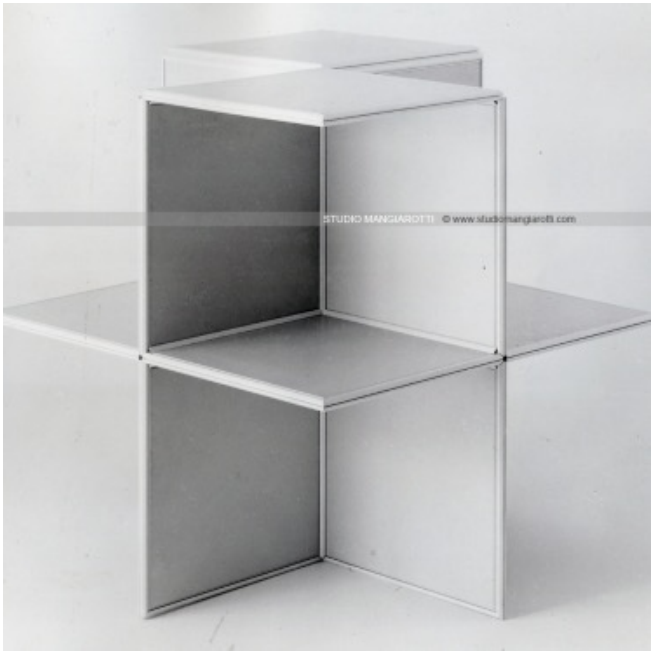


Photo 5 Cub8 by Angelo Mangiarotti for [source: http://www.studiomangiarotti.com/gallery.php?tipo=design&pag=6]

2.2.3. Modularization and Integration: Technological Convergence

The second wave of industrialization was described by companies devising management practices in the railroad companies [Baldwin and Clark 1997] modular design increased the rate of innovation in the computer industry [Baldwin and Clark 2000], and high-fidelity and stereo systems [Langlois and Robertson 1991] in the second half of the twentieth century.

The advantage of dividing a product into various sub-products lies in the possibility of combination according to individual preferences. As Langlois and Robertson [1991, p. 297] points out the nature and the attributes as well as the entity of a product changes over time, as it might be divided.

Let us see here, how might technology converge toward integration through the path of modularization. On one hand there is the tendency of product differentiation [a shift of the markets toward the long tail]. But what we also see today happening over the last less than a decade with telephones is convergence of functions into one modularized object:

DOI: 10.14267/phd.2016007

functions performed by separate products have been brought together into one device. Mobile phones for calling and messaging, computers with internet connection to surf and browse useful information along with emails, tape recorder/ voice recorder, radio, and music player. A couple of decades ago Sony gained huge success by launching a portable cassette player: Walkman [prototyped and first launched in Japan in 1979[13][14]]. It was a simple appliance, which met broadly existing needs and has entirely reshaped music listening habits and consumption patterns. Today, smartphones serve as a watch, videogame, diary, and storage space for a set of different files [sound, pictures, and even documents] in one. Furthermore, by integrating the surface for social media, they redefine the role phones play in our lives, and in broader the market of mobile phones. Smartphones have opened the market for downloadable mobile apps, as well as further appliances to be connected to it, and contributed to the reshaping market of music consumption. Smartphones thus integrated a range of products into one in an unprecedented manner. The analogy however can be found in the case of the story of stereo sets where several sound media, amplification and reproduction equipment were brought together [Langlois and Robertson 1991]. The lesson learnt here is that "technological convergence will open the way for development of multipurpose appliances or modular systems" [ibid p. 299].

A further example is google glass[15] [released in May 2014] extending the possibilities provided by smartphones and incorporating them into an eyewear. The improved product redefines what we consider as 'portable device' [by wearing it on one's face, freeing one hand, and freeing both hands with voice activation], or recording [photos captured on the move from an eye-view perspective], and identification of people, places, objects [through the built in camera] connecting them instantly to gain

[13] http://lowendmac.com/2013/the-story-behind-the-sony-walkman/
[14] http://en.wikipedia.org/wiki/Walkman
[15] https://www.google.com/glass/start/

DOI: 10.14267/phd.2016007

information, or represent in the social media. Furthermore, the meaning of multifunctional is stretched providing with solutions to a larger set of problems [for e.g. translation of signs on the street while walking in a context of an unspoken or unread language by the user, and mentioning the possibilities in healthcare applications for e.g. diabetes]. Google glass has coupled with some frame manufacturers already to add design and fashion to the product[16]. However, google glass still faces opposition due to its privacy-violating capabilities. Google lenses is a further step with a specific focus on medical care functions.

Modularization of a product has implications on the restructuring of an industry. Different components can be produced either internally, or by a set of suppliers [if production costs and transaction costs are favoring it] forming a network. By opening the market through standards, competitors enter, which all brings new dynamics. Furthermore, modular suppliers are free to experiment with product design as long as they follow the standards allowing for compatibility with the product. This is what distinguishes them from ordinary subcontractors [Baldwin and Clark, 1997, p. 85].

2.2.4. The Trade off in Product Design: Integrality vs. Modularity [Decomposability]

Where tasks could be partitioned among different contributors/ collaborators/ suppliers. Mining out the benefits of division of labor might reduce production costs in various ways [see theoretic chapter on modularity]. If just taking into consideration how an object is assembled, the trade off between higher or lower [or no] degree of decomposability emerges due to:

- the costs of joining the elements,

[16] "Google entered in a partnership with the Italian eyewear company Luxottica, owners of the Ray-Ban, Oakley, and other brands, to offer additional frame designs" http://en.wikipedia.org/wiki/Google_Glass

DOI: 10.14267/phd.2016007

- the cost of producing one large element [providing technology for moulding one large part for e.g.]
- sustainability reasons: recyclability of the product
- economies of scale/ customization

It is economic to produce less spare parts, if one considers economizing on joining the elements after production. There are two forces at play: one pushing toward modularizing the elements in order to produce them in large quantities, and the other pushing toward less elements to have less joints and assembling work to be done. Assembling the product can be put on the user, but costs for the user to assemble shall be also considered.

Consider a product design starting from a design with high integrality, that is redesigned in a manner to arrive to a product with high [de]composability: it is not the number of elements that counts, but the level of integration of the different [sub]systems.

Figure 5 Integrality and [De]composabililty

integrality [de]composability

The producer might economize on production costs, but the costs for assembling might rise. To save the benefits of a modular design [to add elements, subtract, divide, adjust according to a given setting and needs] costs of assembling the spare parts can be channeled toward the user. In this case however it is important to design the product to be easily assembled by an average user, or provide with accessible services to assemble the product [see furniture producers].

DOI: 10.14267/phd.2016007

2.2.5. Value Creation

Value of a product can be captured from two basic angles:

- value creation as a result of the design process: where innovation plays role
- what is valued by the user [consumer].

The intersection of the two dimensions is the market, the scene of exchange. The willingness of the users to pay for the good [the outcome of the design and production] is defined by the particular socio-economic, and cultural context. In this respect "value is a measure of an artifact's worth in a particular social context." [Baldwin and Clark 2000, p. 96]. Moreover, value creation is a cultural act [Sassatelli 2007], especially if considering the creative industries producing goods that have aesthetic, stylistic or semantic element [Caves 2000], or symbolic, spiritual, historical value [Throsby 2001].

But how can producers boost the valorization of a product, how to convey the meanings that are valued by the users? Usually goods do not stand alone in the semantic space of the market, but are:

1. elements of a wider narrative,
2. part of a line of products interconnected by one producer, or by the cognition of the user according to some attributes

The wider narrative is fed by the discourse created by the industries organizing the market, as discussed in the previous sections of this chapter.

Now, focusing on the second point, using the frames of economics, still following this line of argument on shaping the demand, we know that:

> "Consumers may add certain attributes and drop others, or they may combine the product with another product that had been generally regarded as distinct"

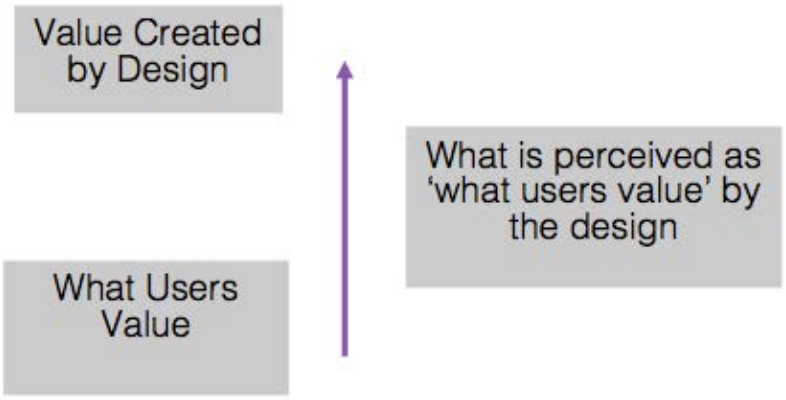
and even

DOI: 10.14267/phd.2016007

> "a product that consumers had treated as an entity may be divided into a group of subproducts that consumers can arrange into various combinations according to their personal preferences".

Products thus, create a *modular system*, which is mirrored by the vertical or horizontal arrangement of the industries [Langlois and Robertson 1991, p. 297].

Figure 6 Value Creation and Design [J. Faludi]



The system of products can be connected by a *brand*, built by a producer [and/or an ecology around it: entities benefiting from and adding meanings to the brand, for e.g. retailers, or a portfolio of designers].

Brands thus play an important role in value creation, as they are "mechanisms that enable a direct valorization" [Arvidsson 2005, p. 236] and a brand value is "an immaterial asset" [ibidem, p. 238]. To stay in the current line of argumentation, values attributed to brands, thus are social constructs, where the public plays an active role on one hand, and narratives created by the companies on the other. However, willingness of users [the public that actually purchases the product] to buy a good at a certain price is the monetary expression of valuing it.

Now, turning toward the first point, thus the *creation of value* as a process generated by the *design* of the product, we know that it relies on the perception of what is valued by the user. Producers use different strategies

DOI: 10.14267/phd.2016007

to shape the user's valuing activity, to tap the user's valuing strategy, or to *involve* the user into value creation. Users can be involved by opening up the design and production process [open design, participative design, open innovation, etc]. In other cases users themselves become innovators, designers and even producers. Moreover, the result of innovation at times becomes a public good, which implies a different valuing mechanism. I will explore and illustrate these points in the forthcoming chapters with case studies.

Now, let me focus here on the problems related to value creation in the design-driven industries through stylistic innovation and how it can be intertwined with technology. *Stylistic value* is ephemeral, and one might find that tangible, or the 'hard' parts of a product design might be those that constitute the longer-term value of the overall value of an object. Stylistic value of what is considered fashionable, trendy, or outstanding for its style, might indeed be ephemeral, although icons of fashion and design become part of the legenda prolonging their value [and the value of the producer and designer], by being exposed in museums, and incorporated into the 'history' of design, and referenced by later works.

However technology is intertwined with other dimensions of the value of the product. Technological innovation in product development might not just serve as a solution to some type of need or problem, where only technology can interfere, shed by the glamour of the visual attributes, and the glamour of meanings created to seduce the users based on what is perceived 'what users value' in its stylistic, or cultural dimensions. Technologically advanced solutions create meanings per se, they become visible and accentuated on the surface of the product, stepping out of the realm of functionality. The invention of plastic frames for glasses and substituting metal, was a huge step forward in regards of functionality: glasses became lighter, thus bringing more comfort and causing less problems for the wearers [less burden for the nose-bone]. The potential of plastic in design of frames obviously was mined out for stylistic purposes, and even a more important innovation followed that of plastic lenses to

DOI: 10.14267/phd.2016007

make glasses even lighter. But how on earth would one imply that wood could serve for producing frames today? Wood here serves several meanings: cultural [the elimination of plastic designed for a conscious user following the 'natural' trend], and a stylistic, where technological achievement of creating wood frames from special wood, with a patented method is visible. Technological innovation here transforms into stylistic value [and of course it is intertwined with stylistic innovation at the same time].

In sum, value creation is a dynamic process, which involves many actors and is based on the interaction of the socio-economic and cultural space of the products. Producers play their role in shaping the cultural space, however the final evaluation of the product lays in the decision of the users expressed by their willingness to pay. The multifaceted approach to product design involves innovation ranging from technological to stylistic, etc. configuration of a product. Moreover, these are intertwined how they enter the semantic field of a product. For example, technological innovation apart from serving functionality has a stylistic value creation force. The next chapters illustrate the above-discussed frames through case studies.

2.3. Spinning the Architecture: The Case Study of Valcucine: Innovation and Modularity from an Evolutionary Perspective

'Spazio della creativita libera' Space of Free Creativity in Pordenone

In this book I claim that we live in the 'age of modularity' that goes beyond being a mere description of production processes, defining our conceptions about objects. It is claimed that modularity served mass production, however I argue, that soon, aesthetics and experimentation of how things are constructed, and the interplay of integrality-modularity, conveyed into the realm of meanings entering the world of conceptuality. Moreover, I challenge the commonsense that modularity served mass

DOI: 10.14267/phd.2016007

production benefiting from economies of scale and division of labor. I shed light on evidence that economies of scope also benefit from modularity through benefits of customization and decomposability-recombination.

The discourse on value creation through creation of meanings in fashion and design is wide, and dating back to decades. A favorable combination and architecture of meanings is valued by consumers, being the meanings of the product shared. Strategies in constructing meanings vary, where designers take on different roles: 1. Designer-entrepreneur, 2. portfolio of designers: recruited by appointing, 3. design table, 4. participative design, 5. collaborative design [see Chapter 2]. Finally, the prototypes are tested for their ergonomics, beauty, and on how the meanings are conveyed, apart from functionality.

In the following columns the case of Valcucine tells a story of a designer-entrepreneur constructing an architecture of meanings based on core design concepts, where the meaning itself evolves from design to design. The most vivid example Valcucine serves with is how design explores the philosophy of degrowth translated into production under the flag of sustainability. We can also see how modularity is at work in conveying meanings: for example decomposability serves the notions of ‘easy to disassemble’, ‘easy to recycle’, ‘lives long’ thus it is ‘sustainable’ and a ‘responsible’ choice in a system of ‘degrowth’. Moreover, decomposability also implies ‘smart design’, ‘well constructed’, and reduction of glue, thus toxic emissions.

In this section I analyze the innovation story of Valcucine from two perspectives: 1. a historical one, with regards to the evolution of innovation strategies of Valcucine, 2. and the relation of modularity and innovation. The relationship of modular design and production was explored in the previous chapters. Next, I point to modularity creating points of entry for innovation on two levels: 1. for sourcing in, and 2. by creating possibilities for architectural and modular innovation [following the frame of Henderson and Clark 1990].

DOI: 10.14267/phd.2016007

2.3.1. Overview. Modularity and Kitchen Design

2.3.1.1. What is Modularity?

First, I recall the main attributes of a modular design. As I have described it in the previous Chapter, complexity is effectively managed by dividing the problem into parts. These parts can be dealt with individually, however they are to different extent interdependent in forming the system they are part of. The architecture [the system] holds together the parts that are independent. The borders where to break a problem, shall be natural, at the joints. Abstraction is the first step to create a module. There are points of interaction among the modules while problem-solving, and interfaces define the way of interaction [Baldwin and Clark 2000, pp. 70-88]. "Manufacturers have used *modularity in production* to simplify complex processes for a century or more", and "modularity in use allows consumers to mix and match elements to come up with a final product that suits their taste and needs" [*ibidem:* p. 78].

Costs and Benefits of Modularity

Next, I bring here a concise reminder of the costs reduced by modularity.

As set up before [in Chapter on Modularity and Design], the following *costs might be reduced by modular design*:

- Minimizing communication costs [encapsulation]
- Economies of substitution
- Modularity might contribute to economies of scale, fostering mass production [in case of Valcucine I bring evidence on economies of scope]
- costs of design reduced: easy ways to change the design structure

Modularity has costs:

- Switching costs to modular design and production I: elaborating standards, establishing visible design rules, furthermore,

DOI: 10.14267/phd.2016007

- switching costs II: as different types of innovation and production require different organizational arrangement and capabilities: it has costs of switching to it [costs of organizational re-design, or raising capabilities]
- Coordination costs among the modules: this can be reduced by encapsulation of hidden information

Benefits for innovation:

- Innovation opportunities: architectural/ modular innovation
- Innovation opportunities for collaborators, entry for sourcing in
- raising options in the value landscape: thus creating more options to chose from

Modularity might hinder innovation:

- creating lock in into a particular system, as systemic innovation is more difficult [imposing switching costs]
- Lack of advantages of integrality [that might be needed for some products], for e.g. lack of the advantage of fine-tuning the integral system [only through modules].

Surely, no clear model exists when coming to practice, thus the fine borderline between what can be considered radical, incremental, modular or architectural innovation might depend from the angle where the impact of the novelty is viewed from. Some products might bring systemic change for the whole industry [see previous chapters], while others represent radical novelty for a subsector of an industry, or a radical switch for the company itself. It is also worth of reminding here, that different types of innovation require different capabilities of the firm, as well as different organization [Henderson and Clark 1990].

A short, to-the-point summary of the main characteristics:

Radical innovation:

DOI: 10.14267/phd.2016007

- shifts the industry/ branches of industry/ the company/s production/ innovation practices
- opens new markets
- implies switching costs
- core concepts of product design are changed
- might be systemic in the sense architecture and core concepts changed
- it creates difficulties for established firms, as it is based on a different set of technical principles
- radical innovation often establishes a dominant design which is followed by competitors, and by improvements [incremental innovation].

Incremental:

- adjusts, refines the product/ product-line/ technology due to improvements
- it also creates followers, a set of competitors
- the refinement/ improvement of the product creates comparative advantage
- core concepts are not changed
- exploits the potential of established design
- reinforces the dominance of established firms

Modular innovation

- core concepts do not change
- architecture do not change
- has costs and benefits as seen above at modularity

Organizational innovation

DOI: 10.14267/phd.2016007

- often follows the shift in innovation practices of a company
- aims at a more efficient arrangement to boost innovation, and cut costs
- might be in line with a switch in production practices
- and serves for raising capabilities of a firm: to create favorable climate for innovation

There is evidence that Just-In-Time [JIT] systems discussed further are backed by modularized production [evidence from the automotive industry: Frigant and Layan 2009].

2.3.1.2. Methodology

This case study is based on a set of interviews conducted at the main showroom in Milan [via Garibaldi] of Valcucine, and a site-visit at the headquarter and factory in Pordenone, Italy [fall 2014]. The interviews focused on production, the core values of Valcucine represented and communicated through its product design, and innovation practices. The site-visit covered an on site understanding of the products and the arrangement of production of the company. After having interviewed the event manager in the showroom in Milan, I was given a detailed presentation in Pordenone, followed by a set of interviews with the communication manager, designers, and I also relied on the information downloadable from Valcucine's website [valcucine.it] where the company self-identifies its main milestones of its innovation story.

As mentioned in the general chapter on methods earlier, this research has faced some limitations and obstacles in data gathering. The story of innovation presented and analyzed here relies on the self-presentation of the company, and did not have the possibility of going beyond the information provided for reconstructing the story. Despite the limitations of adding a critical note, this opened the path for analyzing the innovation story from the perspective of the company communication, thus, understanding how 'values' of the company are represented in communication, branding and innovation and design strategies of the

DOI: 10.14267/phd.2016007

company. What the analysis gained from this obstacle is a more complex view on how a company concerned with branding and communication [which turn out to be the drivers here, as exposed earlier] structure and coordinate design. And exactly from this perspective can one see how stylistic and technological innovation are intertwined, how these two cooperate in heading one for the other.

In sum, for drawing a picture on the evolution of Valcucine I focused on the main changes highlighted by the company [sources were both brochures and the website, of course along with the interviews http://www.valcucine.it/storia_dell_innovazione]. I draw a simplified model of understanding how the different types of innovation cohabit: typified 3: technological, market/ communication and organizational innovation linked to the products. First, combining these three aspects revealed that innovative communication tools backed the launch of new products to the market. The role of efficient and innovative communication is often neglected by innovation scholars focusing on production and technology. This case study illustrates that innovation in style, technological and communication tools are intertwined, as they are combined through the core design concepts of the company.

Alongside the main drivers considered by the vast theoretic innovation scholarship [survival, competition] companies nested into their ecosystem of producing the ‘language’ of design, face a further important push. They need to create meanings in order to be ahead in setting the discourse. These meanings are most effectively transmitted by events and forums targeting audience in an unexpected or unprecedented manner. If we assume that the core design concepts gain validity in the communication strategy of the company, then it is also at hand that innovative communication is antecedent to technological improvements. To illustrate that, I rely on a case grabbed from Valcucine’s series of events. The ‘Kitchen Becomes Open’ project is an example to how effort in exploring communication strategies drives the enterprise toward finding new

DOI: 10.14267/phd.2016007

solutions in a new manner, and finally pushes technological innovation toward new fields to explore [forthcoming in the next Chapter].

Forums for shaping the discourse are the scenes of co-creation of meanings by the players of the field. As mapped in the previous Chapter the establishment creates multiple interfaces for that. Among these, fairs and awards play a crucial role. Companies launch their new products respecting the deadlines, and the conditions created by the events to mine out the opportunities of visibility, networking and reinforcing their product-launching activity. Innovation thus gets a push from the establishment. For the kitchen industry, the biennale event of EuroCucina featuring professionals [architects and suppliers], and the yearly event of Salone del Mobile di Milano gives a push toward new products to be launched [and Fuori Salone toward experimentation in communication]. Despite that the elaboration of a dramatic solution, or refinement of a given product takes years. In this case effective communication tools and incremental, modular innovation is at hand to produce visible results, which can be communicated to the wider public. Later in this chapter I will refer to a ‘design table’ project right in the eyes of the public [‘Kitchen Becomes Open’], which lay in the intersection the push to produce new product, and raising public awareness and visibility [see later].

2.3.1.3. From Composizione del Prodotto Toward Prodotto Componibile

Composizione describes the visual composition of joined elements, blocks of patterns, and colors of an object. The elements of the *composizione* are combined in a meaningful manner. Let us see how it is linked to the design industry. An object is designed to be produced and to be valued by the market. What elements shall enter the *composizione* of the object is as meaningful as how they are arranged. Also they are defined by production. More specifically, by what materials, technology can be used, and what is to be considered as possible value for the market, constrain the *composizione* of the object. Meanings conveyed by the *composizione* are

DOI: 10.14267/phd.2016007

thus defined not just by aesthetic considerations of a given time and designer, but by the available technologies and considerations of production. Just to illustrate that, one might think of the differences of an artifact designed for mass, low-scale, or for one-piece production. Which object enters the field of art is defined by the discourse generated by the stakeholders defining the field.

Now, if an object is *componibile*, it implies that it is constructed of independent elements that are visibly joined. Moreover, *componibile* means that similar elements are designed to be arranged in a given manner, with a possibility of variation. If we consider the *componibile* object as a complex system, it can be best described as a highly decomposable one, constructed of independent modules, with visible interfaces of interaction of the modules. The object, thus talks of its easy *decomposability*. Remember, that the natural borders of the modules can be defined either by their function, or relation to the structure [Baldwin and Clark 2000], see later.

In the story of kitchen or living furniture design the notion of *componibile* implies that it was designed and produced from standardized, independent elements. It is worth to note, that flattening the product by producing independent elements that are to be joint later, serves for reducing costs of transportation and storage. Production costs lower, if a higher degree of division of labor is achieved along with increase in quantity produced and sold. The costs of assembling the product can be lowered by modular design. [Remember the example of Tempus and Hora producing watches, where Hora crowded out Tempus benefiting from modularization of its production [see Chapter 1, and Simon 1962].

But if a kitchen is constructed from independent elements, it doesn’t imply automatically that it can be easily disassembled. Production focused on modularizing the product design.

DOI: 10.14267/phd.2016007

2.3.1.4. How can be a Kitchen Modular?

There is a functional approach to divide a kitchen into elements. In fact, *cucina componibile* means bringing together the previously more independent functional elements of stove, cupboard, refrigerator, table into a more integrated system. Initially these were separate elements designed, produced independently brought together into one space by their function to serve cooking. The integration of these elements served ergonomic purposes: to shorten the time spent on putting ingredients together and performing the stages of cooking in a more efficiently choreographed manner. The functions can be described as storage, cooking, preparation, conservation, cleaning, organizing. Baldwin and Clark emphasize the relationship of the elements to the structure of the system in their understanding of modularity, instead of the relationship to functionality [Baldwin and Clark, p. 63]. If we consider modular arrangement from this perspective then it sheds light on the strive for designing a unique working panel overarching the functionality of the elements of different food processing stages, as well as incorporating and even hiding appliance into the kitchen system, or designing a one-block island performing all the functions.

Experimentation in technology and materials has also led to a modular understanding of a previously one element. Kitchen door for example, plays a role in the aesthetic composition of the system. But, how a door is constructed and how it is joined to the carcass is a matter of technology. How a door can be opened defines the parts it is constructed of: if has a button attached to it, or if it senses human touch, or gravity, or how sound of closure is muted, these all require different technological solutions, which open the path for specialized suppliers. Another example is exposed later in the text, the door designed by Valcucine: based on an aluminum case with a panel joined to it.

Contemporary kitchen can be conceptualized as a system of functional blocks for different activities. Before indulging into the story and the details of production, let us list here the main components of a kitchen.

DOI: 10.14267/phd.2016007

First of all, a kitchen is a durable product, a more or less long-term investment. People with different attributes [age, abilities] use a kitchen. Furthermore, a kitchen is normally fixed physically to the wall, and constitutes an important part of the apartment. A kitchen system can be considered as a product showing relatively low-complexity. The main parts are: a core carcass, with shelve cases and a working panel. Further accessories and equipment can be considered as substructures within the hierarchy of the system. The elements of a complex system interact in a non-simple way, where modularity aims at managing complexity through an interface. [See Simon's description of complex systems in Chapter 1, where a given hierarchy arranges the subsystems of elements]. The most spectacular part of a kitchen is the door, by changing the attributes and characteristics of a door [in texture, quality, materials, color, functions] a visible 'refreshment' incremental/ modular innovation can be achieved [see later].

The historical development of the design of 'contemporary' kitchen fed and contributed to the growth of the industry around it. Kitchen and furniture producers today perform the coordination of the design activity, assemble products, and communicate with the public. They can be described as a nexus of selected specialized suppliers of production and curated set of retailers [sometimes designers].

Manufacturers of:

- materials: wood, plywood, glass, plastic, aluminum
- household appliance, and
- electronic devices and equipment: fridge, cooking panel, stove, etc.
- dining assets and furniture

DOI: 10.14267/phd.2016007

- technology[17] for sound reduction and ergonomics in the kitchen [closure/opening of doors, etc]

grew with the companies engineering and producing kitchens. Showrooms and retailers bringing under one umbrella different brands had/ have maintain customer relations, and provide with interior design services.

The Story of Kitchen Design and Modularity

What would constitute major topics of Made in Italy according to Auricchio [2012] are food and design, while one might wish to add other domains, for e.g. fashion, which can be interpreted as part of design. Kitchen connects food and design in a functional manner: ‘a space to cook’, where how this space is designed impacts the way food is prepared. The twentieth century, especially the period after World War I. has brought about significant changes in lifestyle, living environment, where the role of the kitchen was redefined. Living and housing conditions have dramatically changed: previously there was no tap water or electricity, for example. Especially in rural settings the stages of food processing were different: from the kitchen garden to the table, and waste was processed mostly in-the-household [just think of a chicken, which was processed in-house even in urban settings].

For-runners in what we consider a ‘modern kitchen’ have been spotted in the US in the middle of the 19. CC., where furniture arrangement followed the rationale of functionality [according to Martignoni 2010, referencing Domus 1941, and Catherine E. Beecher’s book on “American Women’s Home” from 1869]. In this realm was developed what is called the “Frankfurter Küche” by Margarete Schütte-Lihotzky, and the Bauhaus conception of functionality and architects entering all spaces of living [Martignoni 2010, p.74].

[17] For e.g. Scic, developed revolutionary solutions back from 1966: corner-systems, shelves inserted in the lower parts, horizontal movement of the shelves [Bergamasco and Croci 2010].

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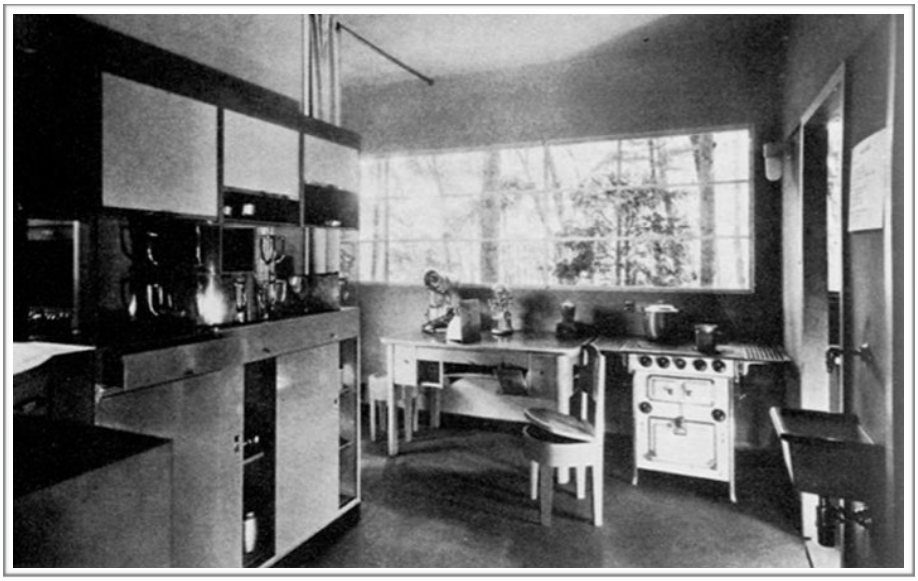
La casa elettrica [source: http://www.archidiap.com/\opera/la-casa-eleelettrica/]

Photo 6

These images of the modern kitchen were backed by the societal changes stemming from urbanization and fast industrialization, which brought about a new role of cooking: it had to be inexpensive, fast and nutrient. Household appliance has redefined the space of the kitchen. In 1930 the 'Casa Elettrica[18]' [designed by Figini, Pollini, Bottoni, Frette e Libera] to model the achievements of industrial design of the times, and to define 'modern life' featured a new concept of a kitchen. [Bergamasco and Croci 2010]. Traditional kitchen had a large cupboard, a table, sink, an oven It is worth to note that Casa Elettrica had a separate dining space outside the cooking space.

[18] http://www.archidiap.com/opera/la-casa-elettrica/

DOI: 10.14267/phd.2016007



Later, the dimensions have even more shrunk: with the cupboard suspended to the wall [replacing the good old, traditional cupboard serving generations of families], the furniture became white, and gas cooking and electricity invited new equipment like gas stove, or refrigerator [which was as big as it did not fit in the panel]. Household products have changed as well, aluminum cookers, plastic pots, coffee-maker: mokka [Bialetti's 1933 model]. Experimentation with materials and technologies gradually modernized the kitchen, and redefined cooking habits [Auricchio brings the example of Teflon-coated cookers, which have dramatically changed how we perceive cooking time]. Lean and fast cooking after long working hours targeted to feed the members of the household.

The fifties have seen the fashion for American kitchens. The concept of *cucina americana* meant a bright, friendly, pleasant and functional space, with a vision of a proud housewife boasting about her kitchen. The Italian version of the *cucina americana* was adapted to the Italian customs, where:

> "Le massaie italiane stirano in casa il loro bucato, e non rinunciano a farsi le tagliatelle.", thus "Italian housewives iron their laundry and, do

DOI: 10.14267/phd.2016007

not give up making their tagliatelle" [Martignoni 2010 p. 80, following „La cucina italiana" magazine[19] from 1929, translated by me – J. F.].

Meanwhile, to reinforce Made in Italy and promote Italian design in living and furniture production, Gio Ponti had initiated the Compasso d'Oro [1954] award backed by companies like Rinascente. The first award went to Augusto Magnaghi who designed the first modular and decomposable kitchen for S.A.F.F.A.[20]. A modular system allowed for a precise standardization, serving mass production. The concept of stylistic independence ["indipendenza stilistica"] the combination of suspended elements with basis. This kitchen followed the path of *cucina americana*.

Another award was given for a vertically decomposable set with multifunctional pots and mugs designed by Giovanni Gariboldi for Richard Ginori [see photo]. It was made of Ariston porcelain, a less expensive a fragile material than traditional porcelain. Both of these products argued legerity, easy construction, variation, space-saving storage and mass production.

[19] http://www.academiabarilla.it/italian-food-academy/biblioteca-gastronomica-digitale/cucina-italiana.aspx
[20] http://www.tavoleadarte.it/10_caf_modulari.html

DOI: 10.14267/phd.2016007

*Photo 7 Modular kitchen S.A.F.F.A. designed by Augusto Magnaghi for Giovanni Gariboldi [source: **http://www.tavoleadarte.it/10_caf_modulari.html**]*

DOI: 10.14267/phd.2016007

Photo 8 Modular, multifunctional set designed by Giovanni Gariboldi for Richard Ginori [source: http://www.tavoleadarte.it/10_caf_modulari.html

The first colored kitchen system was Serie C launched by Boffi[21], designed by Sergio Asti e Sergio Favre [1954]. It featured lacquered wood, laminated plastic worktop, and holds in resine.

A further concept emerged in kitchen design, unifying in one block all the functions. Monoblocco, a single-block kitchen [for Boffi] won the XIII. Triennale prize in 1963. It was designed by Joe Colombo, who is noted for the famous Multichair, Boby for B-line, or the Tubo Chair [Flexiform]. The Monoblocco became an icon, relaunched in 2007. It unites all the essential functions in one island. It was placed on wheels that gave it legerity and mobility.

The relation of modularity and integrality is explored: this one block encompasses all the functions dedicated to a 'modern' kitchen of the times: it is adapted to fast cooking, it is lean, and it is mobile. It brings

[21] http://www.boffi.com/IT/Storia.aspx

DOI: 10.14267/phd.2016007

together previously separated elements into one integrated system: to save time and space: lower costs. Modularity serves for dealing with complexity: the complex enterprise of cooking is manageable in a simple way with a modular design. Joe Colombo's mini-kitchen was radical in suggesting an unprecedented concept of cooking and technology of the times, it featured all the functions in less than 1 square-meters: conserving, cooking, storage, washing for 6 persons [http://www.dammacco.it/wp-content/uploads/Minikitchen-it.pdf]. The single-bloc kitchen was in line with striving of minimalizing, modularizing living spaces. In 1968 the Unibloc 5 model by Makio Hasuike designed for Ariston followed. It was on of the first models to feature a continuous working panel. In the realm of blocks Giancarlo Iliprandi's Rossana RB Cucine [1968] featured four separate blocks made of aluminum and inox combined into an island. It featured the legendary exhibition in 1972, titled "Italy: The New Domestic Landscape" organized in MoMA New York. Monoblock kitchens had seen improvements during the decades [1984. Krios designed by Giovanni Offredi [Snaidero], 2003. Acropolis, designed by Paolo Pininfarina, centers the room, it is a round system featuring a technological center].

DOI: 10.14267/phd.2016007

Photo 9 Minikitchen designed by Joe Colombo for Boffi in 1963 [source: http://www.dammacco.it/wp-content/uploads/Minikitchen-it.pdf]

The fifties have seen further experimentation in adding colors by Boffi, which converted the 'functional' kitchen into 'livable kitchen' [Bergamasco, Croci 2010]. Conceptualizing the kitchen through colors was explored by Salvarani in collaboration with Krizia, expressing the narrative of 'lifestyle italiano' where 'fashion enters the house by its own right' [*la moda entra di diritto nella casa*, p. 40]. Founded in 1939, Salvarani[22] produced decomposable kitchens, starting from the sixties. It was the first company to produce plastic laminated decomposable kitchens.

[22] http://design.repubblica.it/2009/05/11/salvarani-70-anni-di-cucine-sartoriali/

DOI: 10.14267/phd.2016007

Arclinea[23] has added to the discourse of modularity and decomposability. Founded in 1925, the company targeted mass production and easy dismantling. The company's name itself is an acronym of Arredamento Razionale Componibile, thus 'decomposable, rational furniture'. In 1982 Arclinea launched a radical product, Knock Down, designed by Carlo Bartoli. The kitchen was sold dismantled, the elements were joined to a metallic structure. Knock Down featured no suspension to the wall, as it could stand in any space entering the middle of a living room as a matter of fact. [PHOTO source[24]]. Until today the company's design has evolved, but the design concept of a kitchen entering the living space is still a viable one. In the realm of kitchen in the living Scavolini has to be noted as a producer of a series of kitchens [with Gianfranco Vegni].

Photo 10 Knock Down, designed by Carlo Bartoli for Arclinea [source: www.arclineamilano.com]

[23] http://www.arclineamilano.com/it/azienda.php
[24] https://nl-nl.facebook.com/ArclineaKitchens/photos/a.242713615860775.61618.242068982591905/499362693529198/

DOI: 10.14267/phd.2016007

The understanding of contemporary kitchen: modular shelves, cases, suspended upper cases on the wall, working panel have incorporated technical equipment during the decades: the stove and oven has shrunk to fit into the system of cases. Refrigerators have seen two paths: standing on their own, representing its own identity and design, and being built into the kitchen [first the equipment: washing machine, fridge were too large to be integrated]. The late seventies, and especially the eighties saw a shift toward low scale production, mining out economies of scope in the design industry, where luxury gained significance versus functionality. Back in the beginning of the eighties when Centazzo and his partners had taken over a factory producing low cost kitchens designed for the masses, made of wood, plywood, glued, MDF, with laminated surfaces, and lacquered, neglecting environmental impact. The first series of kitchen systems produced by the freshly started Valcucine were in this line of production. Soon the reorganized company focused on low scale production of high quality goods with innovative design. Despite of the economies of scope, modular design of the product had its role in organizing production and innovation flowing through the product lines. It might seem however, that modularity does not have an aesthetic value so explicitly in the eighties, especially in the nineties than before. One might recall the large surfaces, huge, single-bloc working panels and hidden shelves of kitchens of those times.

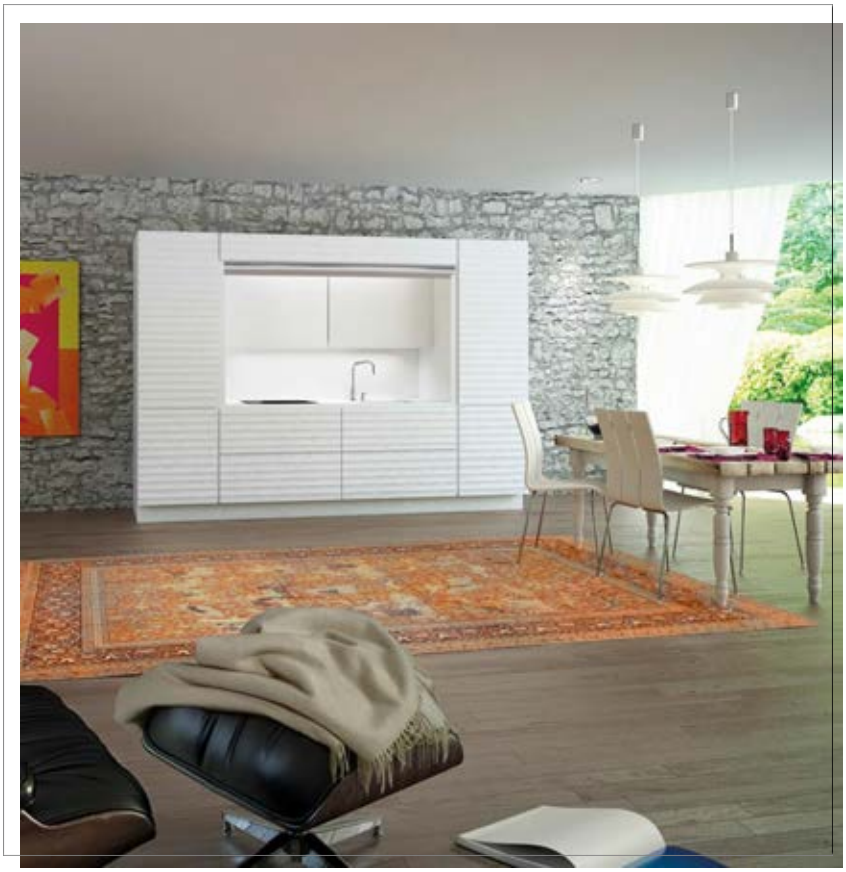
The nineties' design stressed ergonomics, energy-saving features, waste-selection, as well as explored functionality, sustainable materials and high-tech solutions for preparation, storage and consumption of food [Bergamasco and Croci 2010, p. 41]. I draw here a radical example in the realm of ergonomics and sustainability. The model EcoCompatta from 2008, designed by Paolo Rizzato for Veneto Cucine targeted to reduce the dimensions and shape as well as costs and effort to produce and mantle the system. The Ecocompatta plays in the series of monobloc kitchens with

DOI: 10.14267/phd.2016007

rationalized organizing of appliance, functions. This kitchen claims[25] to be developed following the rule of reducing toxic emissions [see photo below[26]].

Photo 11 EcoCompatta designed by Paolo Rizzato for Veneto Cucine

[source: www.domusweb.it]



2.3.2 Architectural Innovation Backed by Technology. The Case of Valcucine

Headquarter and factory of Valcucine is located in an industrial district near Pordenone, Italy. Most of the suppliers come from nearby Livenza industrial district of furniture industry, and suppliers of mechanics from Germany. The founders of the firm [Gabriele Centazzo, Giovanni Dino, Franco Corbetta, Silvio Verardo] took over a kitchen manufacturer,

[25] http://www.venetacucine.com/ecocompatta/ita/
[26] http://www.domusweb.it/it/products/product.9678.ecocompatta--.html

DOI: 10.14267/phd.2016007

Pienne3, with its established clientele, and chain of distribution in 1980. After an investigation how other firms innovate in different sectors, Valcucine's own vision has been set, where Gabriele Centazzo combining his knowledge as a chemist with the role of entrepreneur-manager became 'the' designer defining the line of innovation and design of the company for the forthcoming decades. Recently, the enterprise is challenged by reorganization due to the withdrawal of Centazzo, and acquisition by the Italian Creation Group aiming at bringing under one satellite manufacturers in the field of Home Décor and Personal Lifestyle in Italy.

2.3.2.1. Core Design Concepts as Values Overarching Innovation

Architecture captures how components relate to the structure. A component performs a function within the system and embodies a core design concept. Design concepts defining how to deliver the function of a component might vary, where the *core design concept* is the one that was actually chosen. Core design concepts thus define technological innovation [Henderson and Clark 1990].

Consider the product as a system of components described as architecture of meanings. In my suggested *semantic frame* of *innovation* meanings are encapsulated in the core design concepts of the product. Now, for Valcucine 'values' define the direction of technological improvements of the products, leading evolution of product design and communication. These values were established at the initial, and explored in the second stage of the innovation story of the company, and they are represented in products, product lines, or subsystems of products. I refer to these 'values' as core design concepts bridging innovations of Valcucine over time:

1. Beauty defined as 1. lightness 2. tension of the line 3. diversity 4. Customization for bonding. These represent the core elements of stylistic innovation.
2. Functionality
3. Ergonomics

DOI: 10.14267/phd.2016007

4. Sustainability

Where ***sustainability*** means:

1. Dematerialization, thus reduction of materials used for production
2. Recycling [in sense: recycled, and recyclable]
3. Reduction of toxic emission of [formaldehyde, lacquer, chemicals, radioactivity [by controlling the wood used, since after the disaster in Chernobyl wood of Finland and Ukraine is measured to be radioactive],
4. Long-lasting/ sustainability of aesthetic design and technology

I coin here the term *procedural innovation* to describe the effort that evolves around the main objective to most efficiently elaborate on the core design concepts in technological, and semantic realm. Stretching Henderson and Clark's argument, what I found is that core design concepts are more than just mere technological characteristics. Core concepts define the direction of both technological and stylistic improvements, due to encapsulating the meanings of the product. The architecture draws a semantic and aesthetic frame of conveying meanings. Meanwhile, design rules translate core concepts into the language of technology. From a dynamic perspective design might evolve in time without changing the core concepts themselves. To illustrate that the concept of sustainability at Valcucine for e.g. remains unchanged but the manifestation, thus the technology to achieve the envisioned results is continuously improved. The core concept of *sustainability* does not change, however constant improvements in design cover a process of refinement of meanings encompassed in the concept, driving to further results.

The concept of *reduction of materials used* is best illustrated how they shrunk over the years. Technological improvements targeted the thickness of the surface, and use of less material: for e.g. the door panel shrunk to 5, and then to 2 millimeters, as well as the door panels were substituted with aluminum, and glass. [Back in 1988 Artemica featured 5mm doors:

DOI: 10.14267/phd.2016007

aluminum inside and HPL outside.] This later served two purposes: to reduce environmental emission [aluminum production considered as causing less environmental pollution] and to provide more ergonomic solutions. To tap evolution it is sufficient to look back at the beginnings, when one of the first products of Valcucine back in 1983 was covered with PVC [the doors of Mela]. The concept of reduction of toxic emissions crowded out PVC no matter how popular the imitations of Mela are on the market. Ten years later, Ricicla featuring aluminum doors [considered to produce less toxic emissions during production and use] of 2 mm panels won the ADI design index award in 1996. To efficiently introduce the concept the door was made with a technology adapted from the car industry, which represented a radical turn in kitchen manufacturing. The concept of recycling headed in two directions: a recyclable product and one manufactured of recycled material. Finally long years of experimentation lead to the almost totally recyclable Invitrum [2007]. Evolution of technological innovation here implies the accumulation of knowledge in further operationalization of the core concepts.

Photo 12. Evolution of Design: Reducing Materials Used [Photo taken at the headquarter in Pordenone by J.Faludi]

DOI: 10.14267/phd.2016007

2.3.2.2. The First Phase. Modular Innovation

Doors as Subsystems of a Kitchen to Innovate On

As a kick-off Valcucine followed the line of the acquisitioned manufacturer launching a kitchen with traditional design. This was followed by experimentation with modular design that has set the path for stylistic innovation and adopting new technological solutions, backed by re-organization of production. Subsystems of a product can also be modularized and redefined. As an example, the easiest way to 'refresh' kitchen design is to change either the aesthetics, or adding/ subtracting functions, materials, adopting incremental and modular innovation to doors in a spectacular way. The first significant step towards radical solutions was the second line of kitchens, the *5 stagioni* [1983, Picture 2 source: valcucine.it]]. It featured modular doors wearing an aesthetic meaning of modularity, with a range of possible combinations of color, frame and glass. Here the variation of the quality of the surface, or color gave the impression of constructing a 'new kitchen': components of blocks of color were added into the frame with a silicone trim. On organizational level switching to just-in-time [JIT] system back then, has favored modular construction of the subsystems of the product. The elements became manufactured by a net of suppliers, and assembled in the factory according to the customized product description.

Photo 13. 5 stagioni of Valcucine [source: www.valcucine.it]

DOI: 10.14267/phd.2016007

Mela launched the same year also operated with variability with its PVC coated block-colored doors. Along with technological innovation *Mela* has introduced a new concept of color, modularity and lightness [legerté] in kitchen design. Imitations produced for long by competitors are indicating how radical *Mela* was, effecting the market and the industry switching to this design. In sum, modular design of doors allowed for mix and match of the attributes of the product.

Modularity and Sustainability: From Decomposability Toward Recycling

If a product is easy to disassemble, the elements can be easier selected for reusable waste. Product-design focusing on effective waste management, is concerned about how the decomposed elements will be collected, and managed as waste, possibly reused. The less components/ materials a product features [for e.g. one material], the easier it is to decompose it. Valcucine's evolution points toward a modular design serving reusability and recyclability of the product. The designer, thus apart from knowing about the characteristics and functionality of the given materials, obtains the knowledge of the possibilities of recyclability. If the outside environment is not ready with technology and management to effectively recycle the given waste, in this case, costs of recycling might add [considering the options of in-house recycling] to the overall costs of production. Using recycled material for production is an important message about sustainability. In-house recycling of a given material creates possibility to add the material for further production: either as originating from the own product [recuperated from the consumers], or from other sources. However, according to Valcucine's respondents, consumers do not value final products with visible deficiencies characterizing products from recycled materials [which normally show imperfections], especially for products commercialized at high price.

DOI: 10.14267/phd.2016007

2.3.2.2. The Second Phase. Toward Degrowth and Radical Solutions in Sustainability and Ergonomics

The second phase of the evolution of design of Valcucine evolves around two major stories, sustainability and ergonomics introducing *radical solutions* to the market.

Artematica

Artematica [1988] is the cornerstone of the new phase redefining production and design of Valcucine. As the new dominant design it set the tone for further improvements and radical solutions in the creation of kitchen systems. *Artematica* was the first answer to dematerialization and waste reduction, the achievable results set by the core concept of sustainability. As already said the less materials are used, the easier it is to decompose and recycle the product. Contrasting the modular design of *5 stagioni* and *Mela* doors, *Artematica* featured a single-block door: an aluminum frame as a core structure, to which a range of materials/ panels can be attached to on top: from MDF, glass, to layered laminate, or HPL. The redefined modular design of the door thus creates the following advantages:

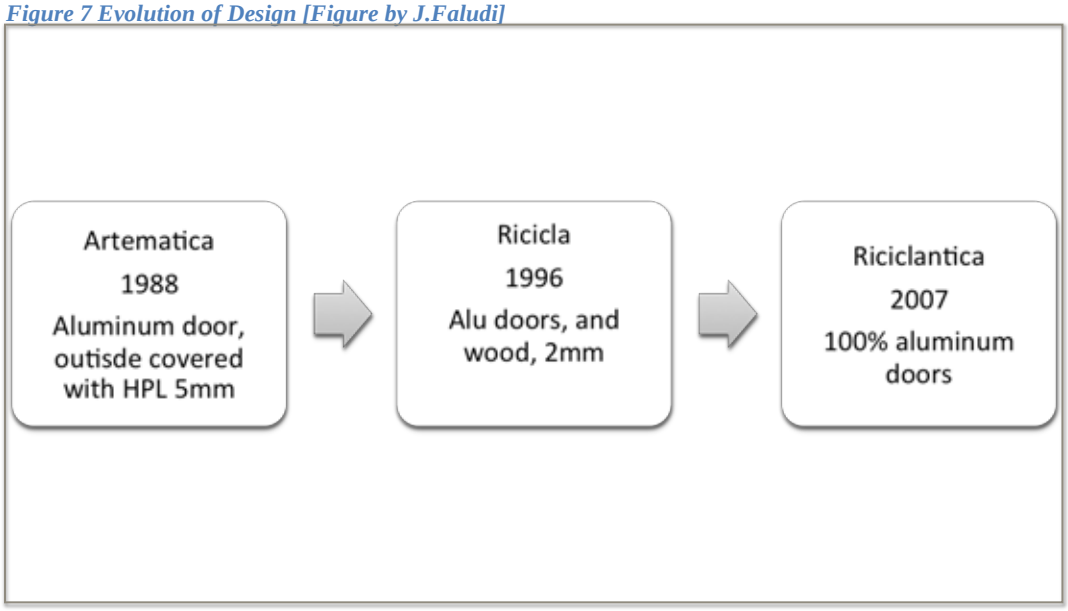
- versatility in materials and colors: adjustable to different tastes
- a single system [of an aluminum frame with the door panel to be attached to] was created for a range of kitchens
- easy to decompose: easier to recycle
- less materials are used [due to the strength of the frame]: less environmental impact

This radical technological solution was easily improved with incremental adjustments. Furthermore, in the semantic realm it created new paths and objectives for the core design concept targeting reduction of materials to evolve. First, *Artematica* featured a 5 mm thickness of doors being attached to an aluminum case. Then evolved *Ricicla* and *Riciclantica*, achieving a 2 mm thickness of the door-panel. The aluminum case opened the path for experimentation with the door-panel attached, which was the

DOI: 10.14267/phd.2016007

basis of at least these three lines of products. Considering that the concept of an aluminum door [with the aluminum panels] was born with *Artematica*, *Riciclantica* is an improvement based on previous results. However, the construction of *Ricicla* was a real breakthrough, and *Riciclantica* brought a radical step in the industry by its 100% recyclability. The intertwined and improved core design concepts drove to radical technological solutions.

Figure 7 Evolution of Design [Figure by J.Faludi]



Invitrum

The *Invitrum* system answers the challenge of contemporary lifestyle on the move, it can be disassembled by the user and assembled in another living environment. By that, the increased lifetime of the kitchen contributes to sustainability [normally kitchens are left behind creating waste], thus the core design concept of long duration is elaborated. *Invitrum* features a further important technological innovation: it is almost 100% recycled and reusable [featuring now the experience gained through the evolution of *Ricicla*]. Avoiding glue toxic and carcinogen emissions are eliminated. As further reduction in materials, there is only one side between the shelving cases [usually kitchen cases are produced as full boxes, fixed together: creating double interior sides: uselessly, for mass-

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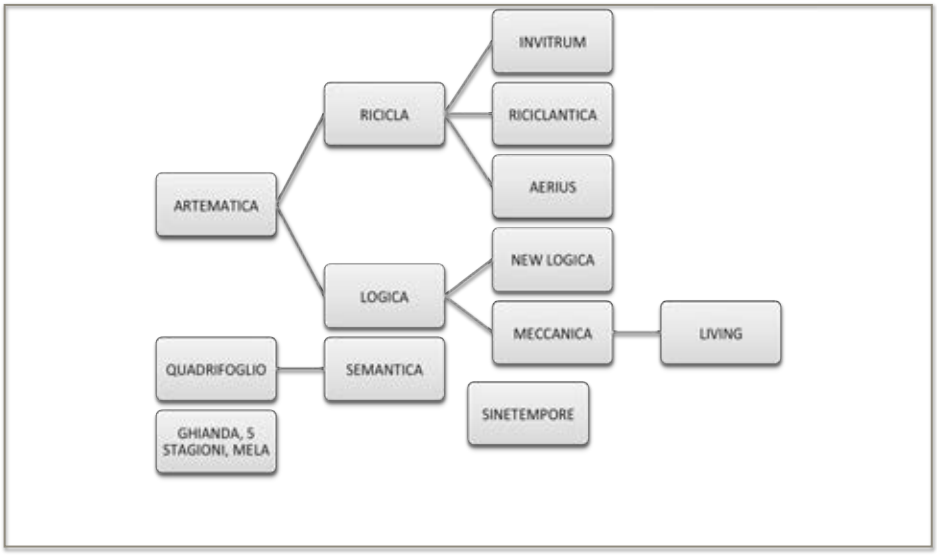
production reasons]. *Invitrum* is made of glass [doors, sides, and working panels] lowering emissions of production.

Some of the core design concepts might feature more significant improvements than others in different product lines. Given that, the architecture changes, as the linkages among the core design concepts shift due to the modified stress on the core design concepts. The other field where Valcucine introduced radical technological solutions was in ergonomics.

Logica

Most important innovations in ergonomics were explored first in *Logica*, featuring *Ala*, wall-unit door that exploits gravity for closing/opening and *Libera*, hood that fread head movements. These achievements have been elaborated, and further ergonomic solutions were added, like the canal built in the back of the washing basin to collect the dishes [instead of putting them to an upper shelf], which can be hidden. The *New Logica System* features a further exploration of these improvements [and see also *Aerius* later].

Figure 8 Tree of Evolution of Design [J.Faludi]



The switch from production of wooden doors and panels to aluminum and glass involved restructuring of technology. Launching of *Ricicla* [with

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aluminum framed doors with a 2 mm wooden panel, and recyclable solutions], or *Aerius* [with radically improved ergonomic characteristics] and glass and aluminum doors can be considered as radical innovations in terms of technology, and of understanding the concept of kitchen design. Technological solutions have an aesthetic value alongside their other functions [sustainability, quality here] that means aluminum and glass surfaces bring about new aesthetics to the traditional understanding of wooden or laminated kitchen doors.

The improvements of *Aerius* combined previously explored solutions: 1. ergonomic [*Logica* system with ergonomic improvements of *Ala*, and *Libera*, and 2. technologic [findings of *Ricicla*] were incorporated into the design of *Aerius*. In this respect *Aerius* can be considered as a model of incrementally improved kitchen incorporating radical solutions from previous models, thus following a design that became dominant in the production line of the enterprise.

As illustrated, *procedural innovation* thus, implies a flow, a spiral-like movement ahead through the core concepts of design in temporality. Innovations started in one model are explored in a later one, while other improvements target differentiating needs shaped by constant changes in lifestyle. Radical and incremental innovation might go hand in hand in one system, or line of product development focusing on different subsystems, and exploring core design concepts. Different kitchen models are being produced at the same time, and recombination of product elements according to needs is also possible. Furthermore, new models crowd out old ones, or older ones are being improved and relaunched, like the first phase of innovations of Valcucine died out while the new second phase products had gained floor.

2.3.2.3. Networks, Collaboration and Openness for Design

Net of Suppliers in Design and Production

First of all, the switch to just-in-time [JIT] in 1983 made possible to maintain and manage a net of suppliers, along with the well-known

DOI: 10.14267/phd.2016007

advantages of JIT: reduction of costs of storage, elimination of risks of stocked goods, flexibility of [lean] production and customization, and economies of scope. Another important benefit is that waste is reduced, which is in line with the sustainability-oriented values of Valcucine. Switching to JIT has contributed to the enlargement of a partnership based on division of labor. There are no shops maintained by the company, as there is no stock. A net of specialized retailers maintaining a portfolio of brands and producers is in charge of distribution. Valcucine plays an educative role for distributing knowledge, thus raising capacities in interior kitchen design for retailors rendering interior design services for customers. Showrooms have an important role in maintaining these partnerships.

Second, the knowledge and capacities of suppliers contribute to lowering the costs of adjusting technologies. As a supplier might produce a range of other products in its realm, technology is used for his specific production needs to be maintained and developed. Thus, if new technological needs emerge, the company does not have to take charge of switching its own technology, as the suppliers are constantly updated, or a new supplier with a more advanced technology can be involved substituting the outdated or costly one.

Third, suppliers while updating their technology might be ahead of the company. Often the suppliers find the company with suggestions/ services based on new technologies. Knowledge accumulated by the supplier thus contributes to the technological advancement of the company. New manufacturers working with new materials also find the company suggesting new solutions and design projects. The company is ready to mine the possibilities of suggested new technological solutions [materials, projects] both relying on existing portfolio of suppliers, and newly established partnerships. Working with different suppliers raises competition among them. Suppliers might also be addressed directly by the company with design needs for improvement of the quality, or enhancing the capacity of the materials used.

DOI: 10.14267/phd.2016007

2.3.2.4. Collaboration for Design

New products and solutions are developed in collaboration with external partners: suppliers, designers, designer companies for finding solutions to specific problems. As an example, collaboration with Electrolux targets to build a single working panel incorporating the cooking panel with no insertion. A ceramic-glass panel for cooking requires specific characteristics [heat resistance, etc.] differing from that of a glass working-panel that needs to be resistant and thin. However, ceramic-glass is not produced in large, only for smaller surfaces. Finding a unified material for large surface combining the needed characteristics challenges technical designers. However, the solution would represent both a technological and stylistic innovation integrating different functions [preparation, cooking].

Product development involves a collaborating team of contributors recruited internally from the technical, marketing and communication office, and external partners: designer, or a company invited for the specific project. The last kitchen presented during the Design Week 2015, was developed in cooperation with an Italian and an Austrian design agency. The invited designer has a general knowledge that interacts with the specialized knowledge of the team of the company about the core design concepts and the accumulated internal knowledge about the products and technical solutions. Collaboration for product development is essential for sourcing in technology that would be too costly for the company to acquire and maintain.

It is the designer-entrepreneur to initiate projects. In the first phase, for aesthetic-technical solutions [coming form outside the company] quality tests are run to reach the needed characteristics. This phase covers research on quality, technology, suppliers and materials. After reaching the prototype, further research is conducted to improve the prototype by identifying and solving technical problems. In this phase of product development technical staff of the factory plays an important role. Improvements are run after launching the product, as it might take long

DOI: 10.14267/phd.2016007

years in a lifecycle: Artematica [launched in 1988] has seen 25 years of improvement. Centralized decision-making in selection of solutions guarantees that the product meets the values and the vision. The role of designer-entrepreneur implies that managerial and financial decisions are taken along with decision-making in development of solutions.

What is in favor of using the net of suppliers in product development is that the language surrounding the artifact is spoken and understood by the close net. Technological characteristics, functions, and the quality of the materials need to be elaborated and exactly identified.

Finally, design of a product requires knowledge of the component, and the knowledge of the core design concepts [Henderson and Clark 1990]. In the demonstrated case accumulated knowledge of the core design concepts lies within the company, and knowledge in production of the components is handled by the suppliers net.

2.3.2.5. Shift Toward Openness?

Clearly, when opening up the design process for a larger set of possible contributors, knowledge might diverge to an extent where coordination and communication costs might crowd out the benefits obtained of the knowledge shared. However, the *Kitchen Becomes Open* project [in 2014 Fuori Salone Milano] was an experiment to adapt the approach of open *design table* for innovators to contribute. A bunch of selected professionals with diverse background developed a kitchen within a week's time, in real time. Moreover, the event was open to the public for comments and contributions. The results were published open access and licensed under Creative Commons [detailed analysis in Faludi 2015B]. What I would like to point out here is that opening up the design process contributed to sourcing in knowledge from the field of digital fabrication, that opens up further perspectives for the company. This specific knowledge lay outside the net of suppliers and partners of the company, thus sourcing in first-hand experience from the world of makers was essential for the company to broaden its vision on technology and design

DOI: 10.14267/phd.2016007

methodology. External designers [12] worked in close cooperation with the designers and technicians of the company. Feasibility of ideas, possibilities and limitations of the company's technological potential combined well with the knowledge and experience of Fab Lab solutions. Solutions opening the door for the user to fabricate her own appliances and robotics in a kitchen is an exciting path to follow, as it challenges the architecture to re-conceptualize the functions of the kitchen and the role of the user, adapted to the shifts of contemporary lifestyle and consumption patterns. By modularizing the design a platform for third party innovators might be created, for e.g. single-user innovators or collaborators [Baldwin and von Hippel 2011: 1413]. By sponsoring an open collaborative innovation project Valcucine invited a larger pool of contributors to innovate.

The trends of slow food, makers, and conscious consumption and perceptions about health, alongside with trends in design need to be embraced to achieve radical innovations conforming the needs of possible consumers. The constant restructuring of the industry and new sets of values driving innovation in the broader ecosystem of design can be channeled in, by getting outside of the 'box' of the well-known net of partners and suppliers. However, as mentioned above, there are costs of communication and coordination of 'openness', as transaction costs of openness encompass the redefinition of the boundaries of the firm, thus establishing the project organization of the design process. These costs are considered by the company along with longer-term benefits in innovation, and shorter-term achievements in communication and visibility.

Technical language of the suppliers and the company technicians is based on terms nominating the specific elements of the modules, quality requirements of the materials as well as specific technology used. When opening up the design and production process, differences of the language spoken by its users might cause communication costs of explaining, and finding common grounds. Focusing on some modules/ elements might contribute to cost reduction.

DOI: 10.14267/phd.2016007

Inventions in kitchen design as spillovers have contributed to broadening of the product line. Valcucine today covers spaces outside the kitchen, for example living room, or laundry [*Valcucine Living* and *Laundry of Valcucine*], that has enlarged the market. These are based on the design of an easily decomposable, transportable and adjustable kitchen, Meccanica, that was adapted to serve further functions. Modularization in this case contributed to an easy adaptability and re-construction serving newer functions. Meccanica branded under DeMoDe [Democratic Modern Design] represents a less expensive product line with a philosophy of 'easy' design, following the conceptual framework of 'degrowth'.

2.3.3. Communication and Core Design Concepts

The second half of the nineties has seen a turn in the communication strategy of the company. In 1997 Valcucine was the sponsor of the *Mazzotti* literary award to gain attention of the public and to identify itself as a responsible company. In 1998 taking the role of the cheerleader the company founded, *Bioforest*[27], an association promoting sustainable production in the industry. By this Valcucine claimed for gaining comparative advantage over its competitors establishing standards in sustainable production.

By adapting the rigorous standards of production as for-runners in the Italian market, the company targeted on the one hand a high-purchasing power and on the other global market of consumers. Despite the efforts to identify itself as that of respecting and promoting sustainability in production, Valcucine has a high target of consumers [overseas], whom value its products rather due to its ergonomic, aesthetic features and high-technology than to sustainability values.

In 2010 *Valcucine Eco Bookshop* opened its doors located in the flagship store in Milan, Brera [via Garibaldi]. The bookshop gathers titles under a

[27] *Bioforest* is located in Pordenone, and runs several projects at the moment, in Italy, Kenya, Ecuador to promote biodiversity, supporting and educating researchers, and preserving nature.

DOI: 10.14267/phd.2016007

range of topics: urban gardening, food design, ethics, responsible design, ecology, architecture and sustainability to communicate its values. The library serves for shaping the sensibility of the audience with its events, discussions, book launch events organized inside the showroom [clearly, it is furnished with Meccanica: the kitchen system that easily turns into a living], and contributes to the discourse of degrowth, and responsible consumption.

Today Valcucine has a strong online presence through projects, brands and social media activity. A blog communicates events and news from the world of kitchen design [ecovalcucine.it]. Brand DeMoDe [demode.it] gathers a set of recent products featuring *Meccanica* engineered by Valcucine. It has its own identity and series of partners, events and activities associated with. For example, Valcucine provides with furnishing [Meccanica] Hub Bari, an association acting in the field of social innovation. Eataly is one of the most prominent 'made in Italy' companies with an international presence in the realm of 'food', 'design' and 'food design'. Eataly's center of food store and set of restaurants in Milan is located in Teatro Smeraldo, a former theatre building. The building has been transformed into a hub of food, where Valcucine maintains its own space for cooking presentations and food design events.

The company runs activities that are aiming at bonding with the [local] public. Together with the Chamber of Commerce of Pordenone the event of Fabbrica Aperta ['Open Factory'] was an initiative to invite the public inside the factory in Pordenone in the frame of Unindustria Pordenone [in 2014], an event shared by a number of manufacturers. Kitchen Becomes Open mentioned above was an open event for the public ran during Fuori Salone.

Recent events framed by Expo cover cooking sessions create opportunities to present the product in its use, communicate values, and to tie links with foodie communities.

DOI: 10.14267/phd.2016007

2.3.4. Stylistic Innovation

Sustainability defines the aesthetics of product design relying on a long-term contemporary look [backed by a life-long warranty of the products]. Interpretation of the core design concepts [of beauty] is context-bound, and dependent on designers. Technological innovation, as unprecedented usage and improvement of materials, has aesthetic value. As it was demonstrated aluminum and glass kitchen doors represented an unusual look back in time, in contrast to the traditional wooden, laminated, or MDF surfaces. Striving for 'eternity' of a natural and elegant look, opportunities for personalization play a key role in stylistic design. Alongside with the range of choices the customer can make, the glass surfaced *Invitrum* allows for personalized pictures and coloring. A further investigation of sustainable production connecting it to 'locally produced' was *Sinetempore* [produced in the eighties and nineties] featuring traditional intarsia craftwork of local Italian artisans decorating wooden doors and panels that were also customized.

2.3.5. Conclusions

Trends of slow food and food design are shaping the discourse on cooking and food consumption, as well as changing lifestyles and diets redefine the role of the kitchen in contemporary urban life. Innovations in digital equipment, smart gadgets and interconnected systems challenge kitchen design. Long tail markets and growing needs for customization and individual design call for the adjustment of development. A possible path to create opportunities for openness of design is more than a mere sourcing in of technological knowledge. Users prove to have a growing demand for contributing to the design, based on a changing understanding of food consumption, and willingness to experiment. These factors imply a shift in the function of a kitchen as an integrated system. Valcucine's *Kitchen Becomes Open* project experimented with creating opportunities for users literate in [digital] fabrication to add solutions, applications and functions to their kitchen. At this point innovation turns user-generated. Suppose, I want to link my toaster or pasta-cutter to a 3-D printer I can

DOI: 10.14267/phd.2016007

obtain my very own features and experience of cooking fabrication [a term coined by me]. The case of Valcucine demonstrates that kitchen design might meet challenges by opening the path for integrating these solutions, and providing the technological and physical conditions for experimentation [space for adding a 3-D printer, or solutions for water reuse management, etc.], furthermore for reconsideration of the 'kitchen' as a system [functions, arrangement, the role of the user in designing and how to use it].

I refer to the values of the company, as core design concepts, laying at the heart of the new product lines. That said, one must notice, that architectural innovation might actually involve improvements in the core design concepts from a technological point of view, however on the level of meanings the core concepts of design remain unchanged. From a three decades perspective, technological evolution thus is supported by an unchanged set of core design concepts. Evolution here implies the accumulation of knowledge in further operationalization of the core concepts [see photo above]. Further modularization of the product here contributes to the redefinition of the architecture. Before moving on exploring the innovation path of Valcucine, first I map what modularity means in the case of Valcucine's production.

DOI: 10.14267/phd.2016007

2.4. Open it Up: A Showroom turned Fab Lab

2.4.1. Introduction

In the previous Chapter I have explored the relationship of modular design and innovation through the case study of a kitchen manufacturer, Valcucine. In this chapter I target the dimensions of open innovation through the case of an open collaborative innovation project. I also tackle how modularity opens the path for single-users or communities to innovate.

Valcucine thus, serves with at least two important cases of analysis in this book: 1. a story of innovation of an enterprise from a historical perspective, 2. open collaboration, and open design.

Modularity serves mass production as well as economies of scope, as I have illustrated in the previous chapter. I also concluded in the previous chapter on the innovation story of Valcucine and broadly on modularity in kitchen production, that:

- modularity might favor mass production as well as customization, thus it serves economies of scope and scale as well,
- despite that the core concepts of design might remain unchanged, but how they are explored in design evolves through time,
- radical innovation establishes a dominant design.

About Valcucine:

- most important radical solutions of Valcucine are achieved in sustainability and ergonomics,
- innovation was driven by the designer-entrepreneur with centralized decision-making,
- the knowledge and technology of the net of suppliers contributes to finding new solutions.

DOI: 10.14267/phd.2016007

Where the last chapter stopped, there continues this one, notably on understanding openness of design. Through the evolution of kitchen design of Valcucine, the pattern of finding solutions did not change significantly: centralized decision-making, innovation generated by the designer-entrepreneur, mining out and sourcing in the knowledge and technology of suppliers. However, the kitchen of the present faces new challenges. The concept of slow food[28] [starting form the nineties], along with the world of makers and digital fabrication, or that of conscious consumption and sustainability awareness enters the laboratory of tastes and nutrition. Precision in choosing and combining the ingredients is combined with creativity fed by abundance of choices, along with real timing that defines new urban lifestyles. Of course, one shall not forget about cooking as a social activity apart from the sense of gathering together, cooking and food design as a way of representation of one's identity in the social media. Preparation and design of food at home is largely inspired by trends presented in blogs, books, and one's social media network. The movement of slow food adds to the discourse by entering and reshaping the field of catering, restaurants and bars. Hardly can one find a *trattoria* [offering home-made quality food of abundance, for low budget] today in Italy, rather a vast range of selection of tastes offered for differentiated needs, with an abundance of narratives attached to each plate. There is a lot of experimentation going on at the merger of food design and digital fabrication[29]. [There are series of examples of experimentation with food-capable 3-D printers, on chocolate, or beautiful pasta with a sepia print, or food and laser-cutting.] But how to understand these needs and moreover, how to channel them into the design of a

[28] See for e.g. Valcucine's cooperation with Eataly in the realm of slow food.

[29] http://www.wsj.com/articles/taste-testing-3-d-printed-food-1420822231 http://www.wired.com/2013/02/10-laser-cutter-projects/ see about Yoda-printer http://www.thingiverse.com/search?q=yoda&sa=https://www.facebook.com/DIMTRE/photos/a.404917122949229.1073741832.374634809310794/404917506282524/

DOI: 10.14267/phd.2016007

contemporary kitchen? How to provide technological and physical conditions for experimentation and fabrication in kitchen design?

This is exactly where the ‘Kichen Becomes Open’ project has tapped into. The point of entrance for makers and digital fabricators was the engineering process of a manufactured kitchen.

Research questions of this case study:

1. How can the benefits of open collaborative innovation project be twisted with open innovation and mined out by a profit-seeking company?
2. What are the benefits of opening up the design and fully revealing the outcomes of the innovation project?

2.4.2. Open Innovation

Now, before moving on with the details of the project, let me recall here what openness means according to the different approaches viable in open innovation scholarship [Faludi 2014]. I assume *design* as a set of rules defining the architecture of the product, and *producer* whom benefits by selling the product [Baldwin and von Hippel 2011]. Innovation openness is where:

- the design is a public good,
- the organization is open for collaboration to an extent to which property rights are defined [producer-driven models].

Scholars explore open innovation [see Chapter on theoretic frames] as:

- user-driven: where users provide with solutions of pre-commercial use and spread, which the producer then improves, and benefits from [scholarship deriving from von Hippel 1976, 1988, 2005]
- producer-driven: where the producer seeks for and channels in external knowledge, benefits from spillovers by commercializing its solutions adapting a business model of permeability of the firm [scholarship deriving from Chesbrough 2006]

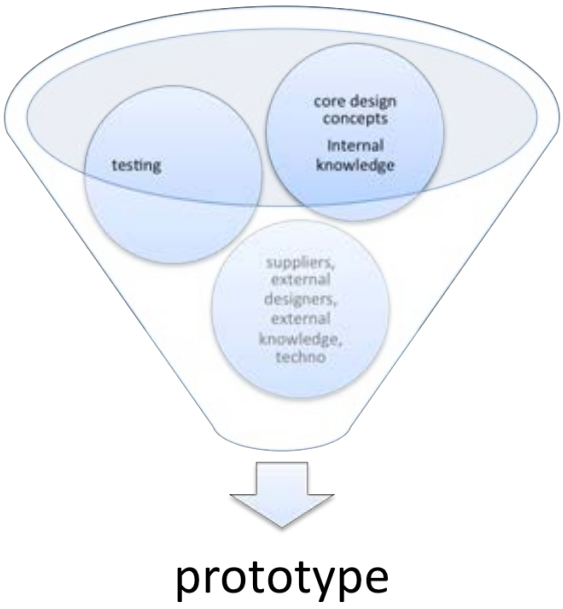
DOI: 10.14267/phd.2016007

- driven by networks and ties over firms benefiting from knowledge-share
- driven by collaboration, or user-producer co-creation resulting often in a public good.

2.4.3. Innovation Process of Valcucine

As it was set before, Valcucine followed the tradition of centralized-decision making of the designer-entrepreneur. The process is not entirely linear from an idea toward a prototype. The picture below shows the vertigo of solutions elaborated, which is a spiral-like process, where the elaboration and operationalization of the core design concepts go along with a constant testing of solutions, new materials designed to meet newer needs, experimentation is going on with a constant interaction with the suppliers, and external designers involved.

Figure 9 The Vertigo of Innovation [J.Faludi]



The research and development phase thus relies on sourcing in external knowledge as substantial technology and capabilities are deposited at suppliers. Valcucine operates with a just-in-time model of production, thus suppliers have a key role in maintaining and improving their technology. The company is nested into the nexus of suppliers within, and outside the industrial district. Moreover, it coordinates a net of external designers

DOI: 10.14267/phd.2016007

working on several projects, where Valcucine's role is to enforce the core design concepts. This implies a grade of permeability of the firm, where further opening implies stretching these boundaries toward fields not encompassed before.

2.4.4. The Core Concepts of Design

Valcucine's innovative solutions stem from a design relying on well-defined core design concepts that are: beauty, functionality, ergonomics, and sustainability [for further specification of the core design concepts see previous Chapter]. In our case it is important to stress that the notion of sustainability covers: dematerialization, recycling, reduction of toxic emissions, long-lasting aesthetics and technology. Valcucine's radical innovation was in the field of sustainability and ergonomics [see previous Chapter], supported by strong communication activity. It might be concluded, that the boundaries of the firm are those of coordinating a net of designers, technology, knowledge, and sellers along the core design concepts, quality control and communication.

2.4.4.1. Toward Open Design

Scholarship on open collaborative innovation has pursued examples in software and hardware development as well as other domains. Open design and collaboration makes possible for a community to develop on ideas, and products in an additive manner. Thus, one creates a design, makes it open for access and use, and others develop it toward further solutions, opening the door for further applications and adaptation to further fields.

There are several aspects at stake here. One is the reuse of a design, thus no design, or idea is lost [at least the possibility of being lost is lower] if it enters a community where anyone can pick and use it. The other is that it brings alternatives to the traditional model, where designers present their work to the producer who decides on prototyping, developing and manufacturing of the product. Now, that prototyping has become less expensive due to technology [3-D printers, laser-cutters, software] designers can elaborate their projects at a different level. A further

DOI: 10.14267/phd.2016007

advantage of what open design suggests is in the realm of broadening the scope of innovation. Fab Labs unite communities fabricating and experimenting on a range of solutions to meet their everyday needs or pursue defined goals on accumulated and shared knowledge. Moreover, communities work on advancement of technologies they use in robotics, electronics, 3-D printing. The RepRap[30] movement started from the UK in 2005, works on developing a 3-D printer to print its own components. Experimentation run by these communities contributes to the overall technological advancement. Makers belong to a community and pursue shared goals, where search also might target some well precised design solutions. Makers are connected to the philosophy of DIY [do-it-yourself], or creating artists, except that they enter the realm of industrial design. Experimentation is at the core of their activity with no monetary incentives.

Open design thus lies in the realm of open collaborative innovation, where the product is a common good. The Schumpeterian understanding considers innovation as that of initiated by the producer, benefiting from the value created. Open collaborative innovation in contrast is driven by users rendering their achievements into the public domain. This has two implications, relying on Baldwin and Von Hippel [2011: 1403]: 1. participants are not rivals, and 2. they do not individually or collectively plan to sell products based on innovation or related property rights. On the fields covered by scholarship on collaborative innovation forms see my overview [Faludi 2014].

Now, if we consider an enterprise commercializing on the value created by its innovation activity, we are bound to think that openness might imply here the Schumpeterian producer-driven legacies, and the Chesbrough [Chesbrough 2006] type of permeability of the firm. Specifically, generating solutions by sourcing in external sources of knowledge, commercializing on spillovers, and mining out partnerships in

[30] http://reprap.org/ http://en.wikipedia.org/wiki/RepRap_Project

DOI: 10.14267/phd.2016007

development for entering new markets. Let us see, what happens if the two worlds meet illustrated in the following case.

As I argued before, experimentation lies at the heart of open collaboration and the activity of makers. Producer-driven innovation relies on experimentation as well, however in the frame of more restrictive rules, and well-defined procedures. Quality standards and technological requirements need to be met, and experimentation is coordinated via well-defined targets, for example to improve the characteristics of materials used, or finding solutions in the realm of ergonomics based on studies. Enterprises spend on innovation, and protect their solutions and prototypes with licenses, augmenting their costs by enabling and protecting property rights and maintaining trade secrets. Experimentation of makers is free in choice of approach and the available tools and methods, while facing budget constraints, however and benefiting from downloadable design and open access data.

Open innovation serves for advancing technology, a practice adopted by Valcucine over the years is to mine its network of suppliers. Suppliers, however also follow the realm of producer-driven innovation for raising the value of their products and to gain profits.

The need for new solutions and advanced technologies, for example to introduce robotics in an unusual manner into the world of food design, or to improve ergonomics in an unprecedented manner, was there. The need for sourcing in new knowledge, and adopt innovative communication strategy as well as design development was there at Valcucine. As well as the experience gained from the world of makers, Fab Labs and open design. DotDotDot is a company merging art, architecture, exhibition design and design, with a decade of experience and a substantial network of partners elaborating multidisciplinary projects with and open and participative working method. DotDotDot and Valcucine had run together several projects before, and now let us see, how *Kitchen Becomes Open* was born and implemented.

DOI: 10.14267/phd.2016007

2.4.5. Ingredients of an Open Kitchen

Now, as I have exposed above, all was ready for the project: experience, identified needs and openness. Here is the shopping list of the ingredients:

- modularized product as a platform to innovate on, that is a modular kitchen of easy design providing with flexibility and a range of solutions to elaborate on, and adaptable to different functions and spaces [Meccanica, see below]:
- knowledge and capabilities of makers and Fab Labs,
- discourse on furniture and kitchen design hyped by the event open to the public [Fuori Salone, Milano],
- partnership providing with specialized knowledge, capabilities and visibility,
- and of course openness of the firm toward experimentation with new solutions in both design development, and communication.

Meccanica is a modular kitchen engineered by Valcucine for flexible needs: it is of relatively lower cost, accessible for larger targets, mobile. It is manufactured in the product line of DeMoDe [stands for Democratic Modern Design], connected to the philosophy of degrowth. Meccanica features radical solutions for reducing materials used. It is 100% recyclable and 80% reusable, it has no glue [thus no formaldehyde emission], it can be personalized [featuring wood, metal and textile]. Meccanica can be self-constructed, disassembled, and then reassembled, modules can be added, or eliminated according to the needs. Meccanica is a mobile kitchen, but as a spillover of the research, it was adapted to living spaces. Due to its mobile construction and modularity Meccanica was already open-ended for user-creation. It served as a perfect starting point, a platform for the designer team to contribute with innovation.

2.4.5.1. How Did the Kitchen Become Open?

This case talks of opening up the engineering itself by exposing it to the wider public, surrounded by the full attention of the press. A larger grasp

DOI: 10.14267/phd.2016007

of knowledge became available through an open call launched on the web targeting at web communities. The design table methodology has pulled together a colorful bunch of designers selected according to a profiling pointing at diversity. The goal was to bring together at one table various capabilities and knowledge, showing larger variety than during the previous engineering projects before. [The project was curated by DotDotDot, and the call was launched here, along with other sources: http://www.demode.it/openkitchen/.] The project has reached out through partnerships to the communities around Fab Labs, digital fabrication and robotics.

Now, instead of a mere description of the project, I highlight here the main stages in a linear way [see table].

The one-week event was organized during the Fuori Salone the ultimate event tackling experimental design in response to and during the Milan Design Week [6-11 April, 2014]. Fuori Salone is “a collection of fringe events”, an “intellectual life of enterprises” devoting themselves to “research and innovation, rather than sales” [Malossi 2009]. It is a response to the institutionalized Salone del Mobile, the event presenting novelties in furniture design focusing ultimately on interior design, with a spring of discussions and presentations. Salone del Mobile is reserved for the establishment, with pre-booked places for the high quality producers in the realm of the ‘classics of design’. In contrast or in addition *Outside the Salon*, thus Fuori Salone, is reserved for experimentation outside the “conventional system of communication”. In this spirit of research and experimentation, *Kitchen Becomes Open* turned the elegant showroom with cutting-edge technology of Valcucine in the posh Brera [Brera Design District] into a Fab Lab for a weeks’ time.

> “…é stato anche interessante trasformare quello che il showroom dal Valcucine. Valcucine ha un target abbastanza alto, elegante, abbiamo fatto un Fab Lab dentro al showroom, quindi gente che lavorava, che tagliava, faceva polvere, é stato molto bello…”

DOI: 10.14267/phd.2016007

"it was interesting to transform the showroom of Valcucine. Valcucine has a high target, it is elegant, and we made a Fab Lab inside the showroom, where people were working, cutting, making dust, it was beautiful…" Dotdotdot, curator, 2014

Table 5 Stages of Kitchen Becomes Open [J. Faludi]

Actor	DotDotDot	DotDotDot	DotDotDot, Valcucine	Valcucine, Dotdotdot, Arduino	Valcucine
	1.	2.	3.	4.	5.
Stages	Elaboration [research, strategy]	Selling [finding a company to implement]	Finetuning, partners call	Implementation	Licensing open source
	The research and strategy behind the concept with the possible risks and results if implemented, was delivered by DotDotDot. Based on their previous experience 'Kitchen Becomes Open' was designed specifically to adapt the design table approach by an enterprise. The aim was to use the already existing tools of open design in a setting where engineering was internal to the firm.	The concept of 'Kitchen Becomes Open' had to find its partners. It was appealing due to its branding value, and as a communication tool for large enterprises. Valcucine and DotDotDot look back to a history of collaboration in the field of communication. Thus contacts were established with marketing, technical, and design teams. The management board of Valcucine has accepted the project after a series of negotiations and presentations based on preliminary research on the impacts of the project. It was rather the communication value that was appealing to the management board. 'Kitchen Becomes Open' fit the line of communication strategy and the philosophy of innovativeness and sustainability of Valcucine.	Close cooperation of DotDotDot and Valcucine in recruitment of partnerships, suppliers, media coverage, and the team of designers.	The literal implementation of the seven days of engineering at the *design table* during the design week 'Fuori Salone' in Milan, implied very detailed and precise organizational work from catering and technical supply to moderating the process of design, and welcoming the interested participants.	The developed projects are open to all. The prototypes are licensed under the Creative Commons, parts and ideas of the elaborated projects can be freely downloaded and used by third parties, given Valcucine is indicated as a source. In this respect there is no direct commercialization. However raising visibility of the outcomes, and the value of the brand being a path-breaker in its approach, Valcucine indirectly benefits from the results.

DOI: 10.14267/phd.2016007

Electronics, robotics, laser-cutters, 3-D printers, and mechanical tools have entered the showroom along with a curious and wandering public, who could freely contribute to the engineering work of a team of professionals. Open discussions and research moderated by invited academics, architects, professionals[31] invited to add comments, ideas, views, arguments to the process by all. The designer team consisted of 12 designers, makers, planners[32] selected from 110 applications. The applicants were ranging from 23 to 62 years old, gender ratio 39/61 women/ men, and from 16 countries, with a diverse background [designer, architect, engineer/ developer, student]. The members of the designer team were hired for this project, thus their contribution was paid. The outcome of their work licensed open access for gaining visibility in the long term.

Besides DotDotDot it is important to hightlight the partnership with Arduino, a for-runner in digital fabrication and innovation platform for makers in the digital world. Coming from the nest of Ivrea [former Interaction Design Institute in the traditional place of the famous factory of Olivetti, sponsored by Olivetti and Telecom], Arduino is a tool "designed for makers and companies wanting to make their products easily recognizable", operating with a community built around it. This international community represents a valuable source of user innovators in

[31] **Giulio Iacchetti [designer], Stefano Maffei [Politecnico di Milano], Dario Buzzini [IDEO New York], Massimo Menichinelli [open design facilitator] Enrico Bassi [FabLab Torino], Zoe Romano** [**Arduino]**

[32] **Daniele Caltabiano** – student, **Andrea De Chirico** – designer, **Laurence Humier** - MISS DESIGN progettista, **Alexander Kashin** - KINK FAB designer, **CÈcile Leporte** - ULTRA ORDINAIRE designer, **Emanuele Magini** – designer, **Marco Napoli** – designer, **Michele Novello** - LABORTORIO GRAFFE designer
Liviana Osti – designer, **Francesco Rodighiero** - SRA designer, **Kodo Sam** – developer, Juan Soriano Blanco- designer

DOI: 10.14267/phd.2016007

the long run, and a potential customer of the Meccanica, that provides with an interface to work on.

Table 6 Partnership of the Project [J. Faludi]

DotDotDot Developer/ curator of the project	Collaboration in the implementation of the project, joint selection of the team
Designers' team 12 professionals contracted for development of the design	Selected through an open call, and contracted for the week of developing the design of the new kitchen
Invited professionals Moderating the design process, leading discussions	Contracted for providing with expertise.
Arduino Digital fabrication, robotics	Collaboration where Arduino provided with expertise, and robotics/ tools as a sponsor
DeMode Production of kitchen Meccanica Providing expertise in construction, mechanics	DeMode is the producer of kitchens designed and engineered by Valcucine.
Spotti Srl. Vendors of Valcucine	Vendors of Valcucine, the showroom in corso Garibaldi, Milano which provided with location is maintained in collaboration with Valcucine
Mechanical equipment suppliers sponsors	Collaboration with sponsors providing the equipment for the kitchen

2.4.6. The Outcome as a Public Good? How Open is Innovation?

First, I go around with the two main approaches to innovation openness, next I will tackle the problem of collaborative innovation. The two main strands in scholarship suggests that an innovation is open:

- where the design is a public good

DOI: 10.14267/phd.2016007

- where the organization is open for collaboration, and the extent to which property rights are defined [producer-driven models].

Now let us see the project from the producer-driven perspective. The initiator of the project was actually a third party, DotDotDot, a firm providing with its expertise in participative and open design methodology. DotDotDot curated the project in close cooperation with Valcucine on organizational matters. Remarkably, DotDotDot was able to answer an internal need of Valcucine "to channel in new resources for innovation for creation of new markets, and to enhance in-house technology" [Chesbrough 2006] by delivering an open design project ready to implement. Valcucine financed the project as an investment in communication, and a range of sponsors contributed. Intellectual property rights, thus the paternity of the outcome of the project went to Valcucine. In this respect it is in the realm of the producer as driver of innovation, however the initiator was a third party, as already said above.

It is important to note that the outcomes, thus designs and prototypes of the project were not patented, but licensed under Creative Commons. They are open access for the public, and can be further elaborated on, or used by other entities certainly respecting the license of Creative Commons[33] CC by-nc-sa 4.0. with the permission to distribute, modify and create projects based on the original, except for business purposes, recognizing the author's paternity of the project. In this sense the direct result of the project is a public good. The license does not allow commercialization of the content, but it allows for modifications, sharing and further development of it. As later I will explain in detail, it is a hybrid model of open innovation. Below, I continue with jotting the main features of open collaborative innovation and open innovation to highlight Kitchen Becomes Open's specific mixture of the attributes of openness.

Following Baldwin and von Hippel's [2011] understanding we might state that it is in the realm of open collaborative project, since the outcome

[33] https://creativecommons.org/licenses/by-nc-sa/4.0/deed.it

DOI: 10.14267/phd.2016007

became a public good. Furthermore, the participants were not rivals as did not plan to sell or commercialize the innovation or the related property rights [Baldwin and von Hippel 2011. p. 1403]. Participants were not rivals in the sense of working within the same scheme and terms of contract, however they can be considered here as suppliers of their individual expertise and their knowledge as a team, accepting Valcucine's paternity of the outcomes, and rendering open access. However, it would be more just to say that it is a hybrid model of open collaborative innovation, since participants didn't contribute for free, being their effort and time paid. They were rivals during the selection period. They commercialized their work delivering it to the contractor, thus they sold their labor and related intellectual property rights to the contractor. This stands only if we consider this project team external to the enterprise. If we drew the borders of the firm around projects, the scheme would look somewhat different.

Table 7 Innovation Openness of 'Kitchen Becomes Open' [J. Faludi]

Open Innovation			
Kitchen Becomes Open	***Open Collaborative Innovation [Baldwin, von Hippel 2011]***	***Producer-driven [Chesbrough 2006]***	***Features***
Yes: licensed under CC 0.4	The innovation is a public good	The producer benefits from the innovation, by profiting or by selling the related Property Rights	Benefits of innovation
Experimentation with no specific product constraint	Collaborators contribute for free to experiment [no constraint] and create innovation	The producer invests in innovation to create value, and targets results [some experimentation exists however]	incentives
Designers were rivals when applied to the team. No rivalry in co-creation of design table.	Designers are not rivals	Designers of innovation are rivals	competition

DOI: 10.14267/phd.2016007

Designers experimented in the frame of a design table, and arrived to tangible results. No specified push, however monetary incentives to produce results.	Innovation to 1. experiment, 2. to create a specific utility/ software, etc.	Innovation to create value	target
Costs related to experimentation, transaction costs	Transaction costs related to experimentation Design costs divided among collaborators, and all benefit the value	Costs related to innovation and experimentation conforming quality and techn standards Design costs born by the producer, whom benefits of the value	costs
For opening up the design table to source in knowledge and expand the market.	For collaboration based on a variety of capabilities	For sourcing in knowledge and technology, raise capabilities, and expand the market.	partnerships

2.4.6.1. From Open Innovation Toward an Open Collaborative Project

It is worth to note, that Valcucine is open to incorporate solutions developed by its partners [new materials, technology]. This strategy of innovation is backed by the just-in-time production system, favoring the division of labor within a net of suppliers. Suppliers demonstrate their competitiveness obtaining and constantly updating their technology and capabilities according to the ever-changing needs. Moreover, they have accumulated specialized knowledge in production that is external to the enterprise [Valcucine here]. In developing and engineering its new products Valcucine has relied on and interacted with its suppliers, rendering it following a semi-open strategy. This implies that Valcucine innovated “having cooperated or bought external R&D”, where most important external knowledge was as important as its internal knowledge [Barge-Gil, 2010: 586-87].

DOI: 10.14267/phd.2016007

To shade the question of openness of the project, I refer here to Barge-Gil's palette of open/ semi-open and closed innovation schemes in the realm of Chesbrough's [2006] definition. *Kitchen Becomes Open* takes here the place of open innovation as the actors innovated "mainly through collaboration with other entities or mainly by others" and "at least one external source" was "more important than the internal knowledge" [2010, p. 586-7]. Internal knowledge of the technical and designer staff of Valcucine served the co-creative experiment to back with technical knowledge on feasibility of suggested solutions, and represented the core design concepts [beauty, functionality, sustainability, ergonomics].

Now, to get back to the line of argumentation, considering the innovation story of Valcucine we tap into the Chesbrough-type permeability of the firm. This recent project however, illustrates a considerable shift toward participative and collaborative forms of experimentation. References to open design, and open-source shaped the narrative of the project, giving floor to wide and wild experimentation, rather than development toward well-defined goals. As I argued above the major difference lies within the question of property rights of the innovation and the benefits obtained. In the next section I explore the nature of experimentation and development in relation to the core design concepts of the company.

Kitchen Becomes Open project is a hybrid model of collaborative innovation in the sense, that the problem is posed by the producer, where solutions are solicited from third parties, despite that selected solutions are not closed by the producer to make profit from, but open [as opposed to closed collaborative innovation: coined by Baldwin and von Hippel 2011, and identified by others and termed 'crowd-sourcing'].

2.4.6.2. Modularity and Open Innovation

As I have demonstrated with the current project, Valcucine applied a hybrid model of innovation, by being a sponsor of an open collaborative project. To achieve this, it has opened a platform for contributions of single-user innovators and a group of collaborators. Producers by modularization of their product can easily achieve this structure, by

DOI: 10.14267/phd.2016007

creating architecture in such a way, where large components are produced, and a number of small components are developed by collaborators or single-users [Baldwin, von Hippel 2011, p. 1413]. Historically, modularization of production at Valcucine involved the organizational restructuring toward just-in-time system of production arrangement [see previous Chapter]. By this division of labor and technology, the net of suppliers served as a pool for sourcing in knowledge for innovation. The architecture of the components and the modularization of the product is engineered at Valcucine. Suppliers add complementary elements to the main structure. Now, let us see how modularization affected the project at stake here. The flexible and highly decomposable Meccanica served as an interface for collaborative innovators to enter. When collaborators are invited to contribute to develop on platforms, they are incentivised by the openness of the outcome, and firms normally benefit by owning the platform. In this case we see an experiment to adapt a market strategy proved to be viable in open-source projects so far.

As mentioned before, when opening up the platform, besides knowledge Valcucine introduced new targets. Entering the world of makers invited to innovate, points toward a longer-term potential to enlarge the pool of users of the product. Meccanica is a platform for makers and for food design conscious consumers willing to add modules developed by communities of digital fabrication. In some, complementary elements are now open to other producers [for e.g. food-capable 3-D printers, laser cutters], and for single-user and collaborative innovators.

Here I bring some examples of what was created by the designers during the project. The solutions followed the philosophy of degrowth, and the core design concepts of Valcucine, however the rigorous control of the usual engineering practice was not present.

DOI: 10.14267/phd.2016007

Photo 14 How To Use Grey Water? [source: demode.it]

DOI: 10.14267/phd.2016007

The photo above illustrates a project[34] that explored how grey water can be reused, for e.g. that of vega-originated cooking for gardening, and cleaning.

A further one suggested to reuse the fabric used for the cupboards of Meccanica, converting into shopping bags. Marina Cinciripi and Vittorio Cuculo designed an infographic with reactive and conductive LEDs tracking kitchen tools and cupboards.

*Photo 15 Showroom Turned Fablab in Brera [source: **kbo2014.tumblr.com**]*

[34] http://kbo2014.tumblr.com/

DOI: 10.14267/phd.2016007

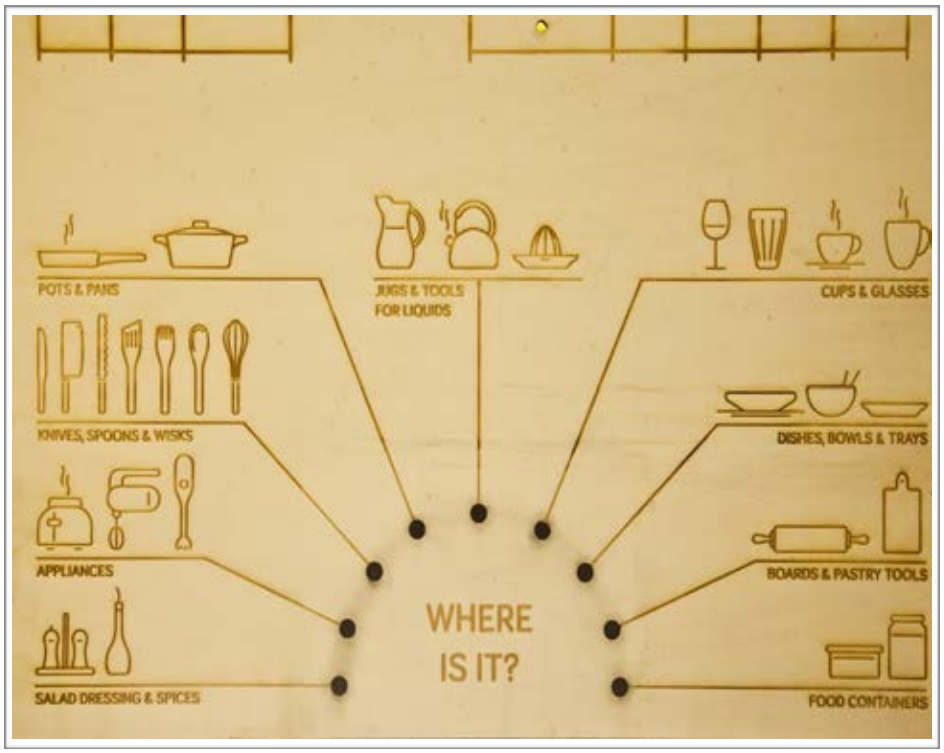


Photo 16 Infographic [source: www.domusweb.it/it/notizie/2014/04/19/cucina_open_source.html]

Governance Structure in Collaborative Innovation

This model of innovation is close to what is described as open hierarchical mode of collaboration. Pisano and Verganti [2008] remind us that openness doesn't suggest flat decision-making per se. They bring the attention to governance structure within the collaboration scheme. In this case, however the project followed the methodology of 'open design table' mining out the collaborator's knowledge with a purposive intellectual division of labor among the collaborators, where decision-making within the process of finding solutions was a centralized one. In this case the decision-making was delegated to the moderators and coordinated by the experts of Valcucine. Historically the company innovates within a hierarchical network of collaborations, where decision-making is centralized, as it was mentioned before. In the case of Kitchen Becomes Open, lab conditions for experimentation, without the strict result-constraint relieved rigorous hierarchy. The next level of decision-making is that of considering the produced menu of solutions ready to be prototyped or developed.

DOI: 10.14267/phd.2016007

Valcucine by that created a platform for entry for innovators: open access solutions are to be developed. The starting point of Meccanica serves as an interface standard for further innovation on modules to be added.

2.4.6.2. Core Design Concepts

As already mentioned before, core design concepts lie at the heart of Valcucine's innovation. To achieve radical innovation Valcucine has explored ergonomics and sustainability during its experimentation in the realm of kitchen engineering. Especially, its latest product line, Meccanica that served as a basis for research and fabrication in the Kitchen Becomes Open project, is a tentative to produce a kitchen exploring the philosophy of degrowth. Sustainability in Meccanica [and other products running under the brand DeMoDe] run under the following concepts defines as 8Rs[35] inspired by Serge Latouche [REF]. As mentioned before, Valcucine has mined out previously its net of suppliers for development and engineering, while controlling and coordinating for meeting its standards and requirements, in respect of the core design concepts, technological characteristics and quality control. Makers do rely on the concepts of reusability, recycling and search for sustainable solutions. Entering the world of makers the core design concepts of Valcucine gain a new shade, exploring solutions along shared values but from new approaches. The widespread argument on the movement of makers gaining power as an answer to economic crisis suggests that the driver of innovation in the case of makers is to find solutions based on achievable raw material [reused and thrifted spare parts, tools, old machinery, etc.] with low costs. This approach serves a democratic way to find solutions to needs, and reuse of available resources, that otherwise would be waste: thus it lies in the realm of degrowth. Furthermore, reduction of resources consumed, like water, energy, gas is also at stake. The solutions developed during the project reflect this approach. It is worth to note, however, that in real life conditions engineering of a new product takes years within the company,

[35] redistribute, reuse, recycle, reduce, relocate, renovate, re-contextualize, re-evaluate

DOI: 10.14267/phd.2016007

as constant testing and fine-tuning to meet the above-mentioned requirements is a rigorous part of the project. The solutions developed as a result of Kitchen Becomes Open were guided by Valcucine's designers and experts, but did not go through the validation channel.

2.4.6.3. Costs Related to Experimentation and In-House Innovation

Let me take the reader back to the previous table [on Open innovation and Kitchen Becomes Open], specifically to the line on costs of experimentation and in-house innovation. Costs of experimentation: "a goulash of both brilliant and dumb ideas", thus it implies the costs of selection of ideas, then costs related to experimentation can be reduced by inviting voluntary co-creators.

Costs of in-house innovation cover the costs of experimentation, and the costs of development and testing for conformity with the technological and quality requirements and standards. Lab conditions raise innovation opportunity. This current project stands in the threshold, where the firm invests in costs of providing with an incubator lab for a team of co-creators [rents, catering, fees, etc.], while providing the results open access freed the company of property rights costs.

In sum, experimentation during the Kitchen Becomes Open project created value for communication of the enterprise at its first place, while the value of innovation is to be mined out by those who will build upon the CC licensed prototypes. Still, according to Valcucine's communication head, at least one solution will be elaborated and launched as a product under Valcucine.

In conclusion, let me summarize the main characteristics of innovation driven by the producer, and that of a community.

DOI: 10.14267/phd.2016007

Table 10. Producer-, and Community-Driven Innovation [J.Faludi]

Makers communities	**Firms**
Public good	Profits
Benefiting from open access, downloadable design and CC license	Costs of property rights protection, licensing
Budget constraint	Investment in innovation
Free experimentation	Experimentation constrained by quality and technology requirements
Open collaborative innovation, co-creation	Open innovation, innovation over networks
Reused design and materials	Reusable design

2.4.6.3. Open Design as Communication Strategy

Kitchen Becomes Open was a powerful experiment to open a platform inviting single-user and collaborative innovators, but more to that, the project contributed to the enlargement of the branding strategy. As we know brands are important as they represent value. Moreover, public values brands based on shared meanings [Arvidsson 2005]. If opening up the product development, public is invited to contribute to the creation of meanings represented by the product [and the brand]. Let me add some further favorable outcomes.

First, outcomes of projects and prototypes available open access when developed by third parties will refer to the paternity of Valcucine.

Second, the project served for raising awareness of the public about the values of Valcucine, providing a first hand experience on how these values [sustainability, responsibility, social awareness] transform into design, backed by debates and discussions moderated by professionals.

DOI: 10.14267/phd.2016007

Third, the project served as a powerful tool for publicity, making the firm visible for the audience. The project was a large public event with substantial media coverage. Large publicity was reached in part due to the partners involved, namely Arduino, and DotDotDot. The spillover of augmenting visibility is shared with the partners as well. Like a festival it draws attention of customers with providing experience and shaping the discourse by colorful events. However these activities were linked to launching specific products, thus representing the 'traditional' way of branding in terms of evoking willingness to buy of the consumer through eye-catching and first-hand experience-based actions. Experimental approach to communication is not new at Valcucine. When launching the Lavanderia [laundry] of Valcucine, people could bring their own laundry to be washed, dried and ironed in the showroom. Series of events invite for cooking using the facilities of the showroom [currently the stand at Expo 2015, or the series of events at Eataly] for cooking and food design activities. Furthermore, to communicate the values of recycling an important collaboration was with Patagonia sports.

2.4.7. Conclusions

Kitchen Becomes Open as a project is an interesting case, as it was initiated not by the firm. It emerged from bottom-up as it was initiated from outside the firm, where the management [counsel of the of administration headed by the president of Valcucine] had to be convinced. The project was elaborated, and underpinned by a feasibility study and research on the effects. The approach of the project covered: 1. mining out the knowledge of a group of expertise showing diversity [background, knowledge], 2. the pooling in external knowledge not contracted/ considered before, but selected through an open call: this goes in contrast with the practice of maintaining a portfolio of designers who are contracted project-based, and selected by a small team [with centralized decision-making] of the enterprise.

The project opened the black box of engineering a kitchen to a wider public. The enterprise threw a bunch of designers into lab conditions: the

DOI: 10.14267/phd.2016007

showroom of Valcucine in the center of Milan was transformed into a Fab Lab for experimentation and with a vague goal to arrive to some prototypes. Sponsors provided with technical support [along with Valcucine's own technicians], and machinery of the kitchen. Arduino took on the digital and robotic input to the project. The basis of the kitchen was the Meccanica[36] produced by Demode and engineered by Valcucine [a modular and mobile kitchen] providing a platform for collaborators to innovate. The project sourced in external knowledge and technology from the field of robotics, and digital fabrication, mining out the potential of communities of makers both in respect of knowledge, and a potential set of innovators to contribute to the main design. Furthermore, it reached out to a potential set of consumers around digital communities. The final outcome of the experiment was unexpectedly fruitful with a range of prototypes licensed under CC, thus launched open access to contributors.

Kitchen Becomes Open can be considered as a hybrid model of open collaborative innovation, where Valcucine sponsored an open collaborative project. Contributors shared their work as a team, and revealed the whole process of engineering. The output however was delivered to the contractor, Valcucine, who finally opened it for use. Participants were rivals in the sense that they went through a competition to be selected and contracted for the project. Innovating based on a net of suppliers lays in the tradition of the enterprise.

Kitchen Becomes Open brought together the concepts and approach of digital fabrication, design for all and participation, which would not have been possible with a classic model of design and development internal to the firm. Knowledge and approach of digital fabrication is an important experience within the technical realm of finding solutions, and furthermore it provides with a further path for understanding user experience in a new way: what would users like to fabricate, and what are the possible points to enter for users in creating their kitchen.

[36] http://www.demode.it/it/prodotti/meccanica

DOI: 10.14267/phd.2016007

2.5. Knowledge-Intensive Business Services in Design and Innovation: Linking the Global with Local

In this chapter I tackle innovation and design rendered as a service by supplier firms to clients. By doing so I am interested on one hand in 1. the relation between openness of the client firm, and client co-creation design project, and on the other in 2. modularization of knowledge as productivization of a service.

I picked two globally operating firms rendering innovation/ design services for clients: Frog and Continuum. Both of them maintain several headquarters all around the world, whereas I interviewed their offices in Milan.

2.5.1. Introduction: KIBS and Modularity

Knowledge-intensive Business Services [KIBS] take their place within the service sector that gains its share in growth in the advanced economies. KIBS are an "external knowledge source and contribute to innovation of their clients", and in their second role introduce internal innovations and contribute to economic growth [Muller and Zenker 2001, p. 1503]. Common features of KIBS firms are:

1. knowledge-intensity of the services provided,

2. problem-solving,

3. interactive and client-related character of their services [following Muller, Zenker 2001 and Ritala et al.], a further feature is the,

4. client participation in the production of the service [Miozzo, Grimshaw 2005, p. 1420].

KIBS render a series of types of services ranging from bookkeeping to marketing, building services or legal consultancy. Scholarship on KIBS focused so far on the content and method of how these services provide with professional knowledge required to run a business. Moreover,

> "Knowledge-intensive business service [KIBS] firms are enterprises whose primary value-added activities consist of the

DOI: 10.14267/phd.2016007

> accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service or product solution to satisfy the client's needs [e.g., information technology consulting, technical engineering, software design].” [Bettencourt et al. 2002 100-101].

Combining their function of problem-solving and providing solutions, one easily arrives to services provided in the domain of innovation and design. However, the scope of KIBS activity has widened, as they enter the world of developing solutions for NGOs, or vulnerable communities answering local needs and challenges with a globalized toolkit. This is what this chapter explores along with understanding how they contribute to raise their clients’ innovation capabilities.

First, let us understand how a firm benefits from providing services to clients. *An other way to ask the question: how can services be organized to be commercialized on?* To answer this question first, I tackle the problem of modularization of this particular ‘product’, see the aspects of knowledge generated, and its implications on intellectual division of labor. Then, based on that sketch I turn toward my two case studies illustrating how solutions are developed and innovative capabilities are raised in practice by two KIBS firms: Continuum and Frog.

2.5.2. Productization, Knowledge, and Intellectual Division of Labor

First of all, we are tackling services that require knowledge, thus produced and accumulated knowledge needs to be packaged into a service [servitized]. Services appeal to the clients as products. Now, knowledge can be partitioned and modularized, and recombined depending on the client’s needs, or the capacities of the service-provider firm. Scholarship underpins this claim, as there is evidence that modularization of the service is a prerequisite to productize the service [Ritala et al. 2013, p. 495], and that productization of services is one of the key capabilities for these firms [ibidem]. To arrive to modularization a *standardization process* of the services is needed, where the identification of the module boundaries is described by the standards codified by the given firm

DOI: 10.14267/phd.2016007

[service-supplier]. Moreover, firms develop capabilities, which the clients find appealing and fitting into their realm of operation.

If the goods [and production] are organized in a modular way it fosters collaboration, by creating entry points [see the theoretic overview of Chapter 1]. Moreover, evidence demonstrates that modular design contributes to outsourcing of KIBS [for e.g. in the IT sector as demonstrated by Miozzo and Grimshaw 2005]. But how can knowledge be broken into parts, and where are the natural borders of modularization? It is worth to note, that the boundaries of knowledge are different from the production of make-or-buy decisions [Brusoni and Prencipe 2001]. This implies that there might be a gap between module boundaries created by productivization of the service from those that are natural boundaries of knowledge modularization, depending on the approach of the firm. This gap shall be overcome, either by bringing in line the two, or by deciding to modularize either starting with the natural boundaries of knowledge [capabilities of the firm], or by servitization accustomed to the client's needs. One way is to codify the knowledge generated as a result of interaction with the clients, and then break into modules to sell it to the clients [Muller and Zenker 2001, p. 1505].

We know, that the flow of knowledge is two-way in respect of KIBS: the firm acquires knowledge from its clients, and provide with knowledge and tailor-shaped services in return by generating new knowledge on the way [Muller and Zenker 2001]. In this role KIBS firms are important players in knowledge production within the economy. But getting back to modularity, KIBS codify the knowledge generated as a result of interaction with the clients, and then break it into modules to sell it to the clients [Muller and Zenker 2001, p. 1505].

Now, let us look at the division of knowledge, first that of the service-providers:

- how to empower the client, how to raise [innovation] capabilities,

DOI: 10.14267/phd.2016007

- how to restructure efficiently the routines to overcome communication problems or difficulties within the client organization standing in the way of efficient project implementation/ raising or adopting innovation capabilities.

and the knowledge of the client:

- the initial and differing capabilities of the members [employees] taking part in the project on innovation and design,
- routines of the client, and among others encompass problem–solving patterns [Cohen et al. 2006]
- absorptive capacity of the enterprise.

By absorptive capacity we mean the ability to exploit external resources to raise innovative capacities of a firm for commercial ends. Based on the firm's prior knowledge, which includes basic skills, shared language, scientific or technological developments, firms evaluate, value and assimilate and apply external knowledge [Cohen and Levinthal 1990, p. 128].

As argued above KIBS firms interact with firms to innovate [Teece 1986], and as a result of this interaction new knowledge is generated.

This new knowledge is also an outcome of client co-creation, that might encompass development of a solution, raising the absorptive capacity of the client, and providing with a tailor made toolkit to raise innovation capabilities through co-design [see forthcoming the case study of Continuum]. Moreover, we also know that client co-creation is most effectively managed if clients are considered as "partial employees", and the service-provider firm applies "traditional employer management practices" [Bettencourt et al. 2002, p. 123].

This latter knowledge is generated in line with a standardized set of toolkits elaborated by KIBS firms. The toolkit is then refined in accordance with the project at stake and based on the experience of co-creation with the actual client, for further purposes. This constant

DOI: 10.14267/phd.2016007

generation, refinement, and codification of knowledge is an asset of the KIBS firms, and constitutes the value added to their products [services], and from a timely perspective contribute to their dynamic brand building.

What we see in the following case studies, is that KIBS do even more to that: they explicitly educate, empower and invite to participate in the design process third parties, often while rendering service to a firm. These third parties range from smaller to larger communities, vulnerable social groups, where the client firm invites the KIBS to develop a solution with social impact. So the scope of knowledge of KIBS covers participative toolkits [see forthcoming Frog]. But before, let us see why needs for KIBS in design and innovation emerge, so we need to ask:

Why Invite Third Parties to Innovate?

From the broader Schumpeterian perspective where innovation is the driver of economic development [1934], we see constant innovation is one of the survival strategies of firms to remain on the market. It is clear that along with those following the path of trial and error are the imitators, but under circumstances of uncertainty and risk, firms need to adapt and be adopted by the environment [Alchian 1950, Alchian and Demsetz 1972, Penrose 1952]. Fitness is defined by their adequate responses to the challenges of uncertainty.

The unstoppable claim for launching novelties, or simply to adopt to ever-changing technological, organizational, etc. changes, challenge the internal capabilities of firms. Firms might turn solid and at the same time rigid in their capabilities of problem-solving, learning skills or in regards their general knowledge, implying more effort to be used. But for developing their innovativeness, firms develop absorptive capacity in one of their areas, for e.g. problem-solving. In an uncertain environment firms need to predict “commercial potential of technological advances”, for being more precise in that they need to be ready to rely on related expertise. This revised expectation “condition to incentive to invest in absorptive capacity” [Cohen and Levinthal 1990, p. 136]. Furthermore, many firms find important to raise their capabilities of managing,

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enhancing and developing innovation. In sum, firms invite third parties to learn from.

Scholarship on sourcing in knowledge, or opening up innovation focuses on the strategic decision of the firm, rather than on the cognitive aspects, which are tackled by literature on knowledge-based theories of the firm. In this chapter I added the claimed for adding the aspects due to the specific nature or the product: a learning process rendered as a service. As this book concentrates on the relationship of openness of innovation and modularity, further I will stress these aspects in my analysis.

2.5.3. Methodology

The following case studies are based on semi-structured interviews with key designers creatives, and creative directors of the companies at their headquarters in Milan. The interviews covered an overview of the development technique illustrated with experience gained through current and previous projects. Names of the clients were not revealed. I aimed at mapping of how innovation and design as a service is delivered. The presented case studies have also faced the limitations described before, therefore the analysis is based on self-referencing, and self-representation of the companies. It is clear that a more thorough in-depth study would contribute to an even more thorough analysis, and a follow-up would add further insights. Besides these methodological concerns, I focused on the interaction and behavior of the actors involved, drawing on the process and some insights of client co-creation, how capabilities of clients can be raised, and implications on generating knowledge and codification. I raise some aspects on innovation openness in client co-creation, and its possible connection to modularity. In the next sections after presentation of the two cases, an analysis follows rounded up by conclusions.

2.5.4. Continuum

The story here goes on two levels: 1. delivering innovative solutions by developing a product either in joint collaboration with the producer or rendering as a service, 2. raising innovative capabilities of the organization

DOI: 10.14267/phd.2016007

at stake. The company delivers services in providing and enhancing innovation capabilities of the client.

Continuum is a global innovation and design company working with a global team of experts providing consultancy in delivering solutions. It was established in 1983 by Gianfranco Zaccai. Among their partners are: Procter and Gamble, Samsung, Nestle, Reebok, Johnson and Johnson, BMW, American Express, etc. The agency has 5 different offices: in Boston, Milan, Seoul, Los Angeles, Shanghai. The idea behind the global net of offices is rather about bringing together cultural contexts under one umbrella, than a geographic representation of the company. Continuum refers to itself as a cultural translator, where the semantic language of the design project is adapted to the cultural context. If a client is willing to launch a project overseas or over the continent, Continuum as a cultural translator involves designers from the target region. Furthermore, there is a global approach to projects, where the expertise of the different offices is counted on for joint projects outside the realm of cultural translation, but due to professional skills that can be fruitfully combined. There are more than 160 employees overall at the company, but it maintains a larger network in various countries for projects. The top management of the company is in Boston, which is also responsible for global talent scouting. The headquarter in Milan [that I visited] consists of 15 employees.

Continuum has the capability and capacity to deliver projects from ideation to development and even organizing pre-production, depending on the needs of the client. The extent to which the client is involved depends on the volume, nature of the project, and the willingness of the client and the service-provider. Regarding the different approaches that evolved through time and are present at different companies on the market, the respondents identified the following:

1. Design is delivered to the client based on exact description and concept of the product the client needs. In this case the supplier provides with a set of drawings literally, while the client takes charge of the process from the pre-production phase.

DOI: 10.14267/phd.2016007

2. Beyond pure drawing [design] of the product, the supplier adds perspectives to the client, based on the knowledge the supplier gained by being on the market. Moreover, the supplier company mines out a pool of fresh contributors.

3. Partnership. The body of experience and reputation of the company on the market gained [maybe during years or decades] provides with an impressive portfolio of cases and designers. Thus, the client can benefit from a wider range of services from ideation to the whole development process. In this realm enter KIBS firms into co-design projects with the clients. This process is described as "you don't perceive anymore who is the author, or who obtains the most value out of the project that u run". **Co-design** implies a joint work of the internal team of the client with the team of the service-provider. Problems and stages can be divided among the teams to work on. The client is sometimes involved not just for data-mining reasons at the initial stage, but also in the strategy phase or in the research phase, where the identified problem is elaborated.

"so we teach them, how we are able to generate data, to capture, to filter information, and so it was much easier for them to understand the values of that information, those insights during the strategy part." [designer, 2014].

Marker of an efficient co-design project according to the respondent the authorship of the outcomes.

Table 8 Features of Continuum's Methodology [J.Faludi]

Features of Continuum's Methodology
• global pool of expertise for projects: core teams recruited from a global pool
• cultural translator bridging the global with local
• involving the user at the initial stage of development
• consistency of idea and concept to the final stage
• non-linear approach to development mining out the different capabilities of the client at one table
• knowledge-transfer and raising capabilities of the client for innovation

DOI: 10.14267/phd.2016007

To continue with the main features of the company's methodology, one key element is inclusion of the user at the initial stages of development. This anticipates the testing phase, thus saves time and effort, however it comes after establishing core values. Users are selected according to a profiling based on behavior patterns rather than socio-demographic or other quantitative attributes. These are identified for each project at stake.

Another crucial aspect is the consistency in keeping the identified messages starting from the ideation phase to the end. This might imply tension with the client involving different organizational departments with scattered and accumulated tacit knowledge of previous routines and products. This knowledge might constrain both the new methodology of development applied, and the new concept of a product. Marketing teams accumulate knowledge about previous products and product lines and combinations of products: their structure, shape, how they were launched and sold on the market, as well as perceptions about customers. This latter can be conflicting with the behavioral approach to the user [meaning that profiling of the user is based on behavior patterns, while socio-demographic and other quantitative characteristics are taken into account to identify consumers] elaborated by the service-provider KIBS firm.

The benefit of a non-linear approach to development mining out the different capabilities of the client at one table: the linear process of internal development of a product is now rendered into a package of tasks where at one design table all information and ideas are gathered. This speeds up the process on one hand, by eliminating dead-ends [e.g. developed idea, that is not suitable for production due to technological or budget constraints, and then the process starts all over again]. The KIBS firm, thus rearranges communication paths, and organizational routines of internal product development of the client.

There are several approaches and types of projects that could be modeled within the history and scope of activity of Continuum. However, below I draw on modeling the co-design project approach, constraining from

DOI: 10.14267/phd.2016007

indicating the names of the clients. I found the cases of co-design interesting for two reasons: 1. knowledge-share and the implications of the knowledge generated, 2. the natural module boundaries and division of labor.

Projects of co-design imply the close cooperation of the client and the service-provider for finding solutions, and more to that for raising the capabilities of the client firm to innovate. This later implies learning and adaption of new organizational routines within the frame of developing solutions. The service-provider thus facilitates the process based on a pre-defined [and refined and adapted to the project] toolkit. The extent of the involvement of the client varies according to needs, structure and measure of the client firm. The case I modeled below involved a larger set of contributors from the client organization, involved in the core design team. I relied portraying this larger partnership for reasons of exploring the possibilities of knowledge flow that can be narrowed, or reshaped in other projects. This case involved managers of five departments of the client covering activities normally used in a linear manner for design within the firm.

Figure 10 A Co-Design Project Interaction [J.Faludi]

Co-design projects entail the risk of the low level of involvement of other departments, or weak communication inside the company about the project. In this case the outcome does not enjoy legitimacy and support of

DOI: 10.14267/phd.2016007

the rest of the client firm, which might create tensions in implementation. The reason behind that is exactly the fact that the KIBS firm enters the realm of routines and tacit knowledge of the client firm.

Below, I list the knowledge entering co-design, and how it interacts during the process of development. I didn't enter the knowledge generated, that is put use in two ways: the results are benefited from by the client, and the knowledge acquired is codified and incorporated into the body of knowledge of the service-provider for further projects, and refinement of methodology.

Table 9 Knowledge-Share and Production in Client and Service-Provider Interaction [J. Faludi]

Knowledge of the Client	**Knowledge of KIBS firm service-provider in design**
Internal, accumulated knowledge of: Products, product lines, compatibility of products Technological capacity Budget Market: Consumers of the previous products Organizational routines [path dependence, hierarchical solutions]	External to the client, accumulated through other projects: Cultural contexts [cultural translator] Conceptual approach to design, toolkit: protocols for all phases of design development accumulated along other cases Market data User profiles based on behavior patterns market information based on user info and secondary data Rearrangement of organizational routines through new communication patterns and vertical arrangements
Data> Content> Implementation>	<How to design and implement, methodology and conceptual frame <How to rearrange organizational routines

The role of 'cultural translator' is reinforced providing legitimacy of the knowledge added by the service-supplier. The service-provider guarantees that the core design concepts identified during ideation are to be fully respected along the development process and argued in the solution elaborated during the project. That is part of the knowledge of the KIBS firms. The service-provider thus takes the 'leader' role, to effectively manage the co-creation by treating the client as "partial employees",

DOI: 10.14267/phd.2016007

applying "traditional employer management practices" [Bettencourt et al. 2002, p. 123]. The knowledge of the KIBS firm is exactly what it supplies, thus it needs to be firmly articulated, at some point overwriting the client team's points. For e.g. the service-provider claiming [and commercializing on this claim of] being a 'cultural translator' needs to stick to what it considers in line of what was co-created as a 'message' a product carries. This knowledge stems from accumulated knowledge from previous works, provides with legitimacy to be argued during the design development process.

> *"so we need to argue that it is not the matter of doing everything that u can, but it is the matter of doing one thing with a clear message, that people understand immediately when he or she sees it on the market."* [creative director, 2014 fall].

> *"they should go straight towards the boldest problem-solution, but people from the marketing inherited what they always had in their portfolio they try to put through in everything, that is a destruction of the core message of the product the way it should be"* [creative director, 2014].

2.5.5. Frog Design

"we want to innovate the users experience"

Gianluca Brugnoli

Frog Design was founded in 1969 in Germany by Hartmut Esslinger[37]. Without going into a detailed description of the evolution of the company

[37] "Ushering in an era of emotional design in response to the mostly function-oriented products of the day, Esslinger design was born out of a desire for improving the everyday lives of people, a passion for innovative technology, and a willingness to work directly with a client's top management and strategic focus on economic success." http://www.frogdesign.com/about/history.html

DOI: 10.14267/phd.2016007

[that can be read on the website[38]] I highlight two major products Frog design developed: Sony Walkman [along with a 100 other products for Sony], and Apple Computer IIc system [that was design of the year of Time Magazine in 1984]. Starting from 1990 Frog Design is involved in software and applications development as well, and currently is active in social design contributing to companies like Unicef and PopTech mining out its capabilities in software design for social projects.

Frog is a global company, representing a net of headquarters working on different set of projects across the world. These headquarters work with their own parallel set of designers, responsible for their in-house projects. I visited the Milan headquarter where approximately 50 employees work.

In all cases ethnographic research [direct observation, shadowing [, interview before/after/ only after the experience, diaries, contextual interview, social listening] and a toolkit addressing to explore user behavior patterns and motivations is a substantial part of the start of the project [thus again, not quantitative socio-economic attributes as in market analysis]. The core research approach of the company is structured around 3 types of client's needs:

1. **Goal-oriented design and research**. In this case the client addresses a specific target [see in the previous case study], with a more-or-less detailed description of the product that is required to be achieved. In this case research tackles user behavior and context, and the design process goes toward well defined goals.

2. The second case brings about the challenge of **redefining a non-selling product**, where the client requires expertise and knowledge of the service-provider to conduct a thorough research aiming at identifying user-behavior and context for the specific product at stake. However, in this case a precise and broad approach to the market [thus beyond the specific product to understand the users' relation to other similar products] is still

[38] http://www.frogdesign.com/about/history.html

DOI: 10.14267/phd.2016007

needed, as solution [improvement or redefinition] shall be elaborated based on the research.

3. This case represents the technology-driven design, where for an existing technology the opportunities are identified for developing a yet undefined solution.

Based on the information gathered on user behavior and motivations, and contexts user archetypes, thus *personae* are constructed, and put on a map, to facilitate modeling a possible range of solutions developed. A further important outcome is the *customer journey* describing the experience a user has while using the product, that is more about a service or application. Users perceive as a single experience a set of services, touch-points, suppliers, technologies, design artifacts. Examples might range from a flight experience [book the flight, pay for ticket, arrive to the airport, airport services, catering, the flight itself, arrival from the airport, booking accommodation, renting a car etc.] toward a restaurant experience [book, arrival, parking, or taxi, interior design: the set and the table, menu: food and drink, waiting, payment options, restroom, etc.].

Frog also works with codified procedures, that means that protocols define the stages of work carried out in design. These are standardized procedures defining all the steps on how to proceed. The protocols are constantly refined according to the experience gained, and the project. Frog itself [that means the designers] codifies the toolkit, which is a constantly on-going work, with updating based on experience, and on anticipated challenges to be prepared to. When designing for a client during the process designers establish core design concepts that are reused. These core design concepts are defined based on the personae matrix and the map.

Co-creation with the clients is part of Frog's approach depending on the specific projects and clients' needs. The process of work described is based on a set of workshops, but this set of workshop does include work with the clients. Workshops are organized for the client, users, and the core design team of Frog, and for the client and the core design team

DOI: 10.14267/phd.2016007

together. These workshops are organized for mining out data from the client, building co-working team, and for transferring knowledge based on elaborated toolkits [tackling internal knowledge, targeting defined goals, and stretching routines, etc].

The workshop focusing on the interaction and co-creation of the client and designers addresses team-building techniques to set a common mission. Knowledge is generated and transferred to the client through home-tasks to be solved, etc, thus the client needs to deliver content to the design project. The client's team is created involving different departments and functions within the organization, depending on the project.

The knowledge delivered is structuring obtained information by splitting it into parts and rearranging it along clusters. For understanding user experience as a matter of fact a thorough modeling and deconstruction of the elements is needed. In order to develop solutions, or a system of solutions [user experience], these elements need to be clustered, modularized and reconstructed.

2.5.6. Analysis: The Locus of Innovation and Boundaries of the Firm in Co-Design Projects

Transaction costs theory of institutionalist tradition implies a linear approach toward production and design, thus as a sequence of different stages. The above depicted co-design method [more visibly in the case of Continuum] however, models an iterative process, where capability theories of the firm concentrating on what a firm knows [organizational routines, tacit knowledge, etc.] seem to be more at hand for capturing firm boundaries.

2.5.6.1. Standardization and Module Boundaries

Protocols for dividing the tasks and specifying the exact implementation are set at the beginning of each project, and refined during the process. They accumulate the knowledge gained in previous projects. Protocols setting the rules for the design process can be considered as standardization of module boundaries. protocols define the borders of the

DOI: 10.14267/phd.2016007

modules of the tasks, split by the knowledge interacting. Generated knowledge benefits the client: through commercializing on the results of the project, and it benefits the service-provider: knowledge accumulated for further projects.

The division of labor along the departments within the client's company is redefined by the co-design project as different functions and representatives of various departments are brought to one table, which rearranges the linear process of internal design. It makes possible to reveal all possible problems, constraints that might emerge.

2.5.6.2. User at the Core

Both companies relied on the significance of the user in the design process, on understanding the behavior and motivations. This approach delivered by the KIBS firms is in contrast with the consumer-oriented approach of companies that traditionally rely on socio-economic attributes of profiling.

2.5.6.3. Global Design? Local Solutions

However scholars argue on the embeddedness of KIBS that requires specialized knowledge and networks in the local socio-economic and cultural context, another trend that flies in the face of this argument, is a global-scale sourcing in of KIBS as a practice. The two are not contradicting, as on one hand services can be split and provided by a larger pool of expertise or set of headquarters featuring specialized knowledge. On the other hand global companies rendering services search for local answers to the client's problem. Finding global solutions is underpinned by several factors. First, companies do not forcefully have to be multinationals to operate on an international scale, entering globalized markets. Second, consumer needs are usually met based on a globalized toolkit of product development. Third, production is embedded into a globalized economy. KIBS firms in the domain of innovation and design are present in the globalized economy, just as other economic players.

DOI: 10.14267/phd.2016007

Globalized economy creates a globally shared language of meanings conveyed by the products. To speak this language, companies follow different strategies, for e.g. in the design-driven industries they might work with a portfolio of designers carefully curated to overarch cultures [Dell'Era and Verganti 2010].

Continuum provides with a pool of international [global] expertise, which can be localized if needed, or mix-matched to conform the needs required to perform well in the global market. The language products [services, solutions] speak must be conveyed in a manner to be read by consumers coming from different contexts, and on the other hand requiring a meta-language read by others in a web of world-wide users. Thus, if I buy a specific product, I want its value to be read by other consumers no matter which geographic location I am at, but still rather belonging to a group of consumers with similar or same set of preferences. While Continuum operates as a 'cultural translator' providing local, thus with designers conveying meanings to the regional cultural context included into the core design team, in contrast, Frog works with a net of offices all around the globe, that have parallel capacities for rendering similar services.

2.5.6.4. Social Innovation and CSR as a Service Provided by KIBS

Apart from opening up the design process, the developed toolkit might enter common knowledge. Frog Design for e.g. published its Collective Action Toolkit elaborated to empower girls to solve local community problems open access [a project initiated by Nike Foundation].

Innovation thus enters the field of **social innovation**. Brands targeting social impact design projects aim at combining their meanings of 'innovative', 'responsible' [CSR], and create meaningful actions to the community involved, and larger target that 1. is to be sensitivized, 2. willing to adapt the elaborated toolkit/ project. Moreover, by empowering communities, the explicit target is to foster growth, thus creation of a larger market for the goods branded. As a result the enterprise puts itself forward to innovate, and cooperate. The first step taken is the realization of the lacking knowledge, and inviting the source of knowledge [expertise

DOI: 10.14267/phd.2016007

in innovation] from outside. This stretches the Chesbrough model, as sourcing in of knowledge is at the level of firm capabilities.

2.5.6.5. Openness

Openness here refers to the permeability of the firm requesting the services. By these tailor-shaped services yet requiring specialized knowledge services the provider enters the internal structure of the enterprise in question. It penetrates into the client organization's routines and hierarchical arrangement [by organizing meetings, delivering tasks, inviting to a shared communication stream, or table those with different set of responsibilities] and reshapes them. The challenge here what the client faces is the lack of capabilities to [re]adjust itself to adapt to the challenges of constant and relevant innovation. Innovation here covers organizational routines connected to product development, as well as organizational renewal. It searches for the arrangement and set of capabilities enabling it to innovate. We know, different types of innovation require different capacities of the firm [Henderson and Clark 1990]. Furthermore, a client might invite the KIBS firm to improve the design of a product launched unsuccessfully to the market. Within the process of identification of the problem, a constant interaction with the client takes place involving knowledge-share and generating that contributes to raising capacities of the client. In sum, modularization of KIBS firms serves to keep flexibility for mix-matching of elements to meet customized needs, and to create entry points for innovation.

However, it is worth to note that it is a closed collaboration scheme. No further parties enter the process. The service provider takes over the coordination of the design process. The client remains the coordinator of its brand, or the core concepts defining its brand(s). Branding itself can be outsourced to a service-provider, if the concept of the product is ready for production and branding (I didn't cover these service-providers here).

DOI: 10.14267/phd.2016007

III Conclusions

3.1. Strategies for Innovation and Design

Throughout this book I investigated the relationship of modularity and innovation through the lenses of behavior of firms nested into an ecosystem. As at the end of all the chapters and case studies presented in this book I provided with conclusions, here I just sketch some perspectives based on my generalized findings. The current book is based on an explorative research: that means tapping the different patterns with an in-depth analysis shaped the methodology applied.

My intention was to hint at the complexity of production, and to introduce semantic aspects apart from technological and organizational ones to understand innovation and product development in its interdisciplinary and multifaceted nature.

The introductory chapters on design showed that producers organizing the market involve different players acting in the ecosystem to establish, shape and maintain the discourse on design.

I demonstrated that modularity apart from its meaning on how to arrange production, the firm, and production systems enters the realm of conceptual understanding of an artifact, with examples grabbed from the history of design. I pointed out the convergence of modularity, technology, stylistic, and technological innovation.

The toolkit for analysis within this research was framed by an integral approach stemming from modularity and innovation literature along with organizational science scholarship.

In the field of design-driven industries in Italy [with a fieldwork based in Milan], I explored how the complex systems and modularization works in these peculiar areas of production. After drawing the map of the ecosystem for innovation of the given fields, I examined case studies revealing innovation strategies of firms mining out modularization. With

DOI: 10.14267/phd.2016007

the case studies I illustrated and analyzed in-depth how different sources of innovation collude with modular design and production:

1. in Design-Driven Industries [modularity mining out economies of scope and scale, interaction of players, ecosystems for innovation]
2. The role of experimentation and the implications to the field.

Main strategies:

Traditional Italian firms look back to decades spent in the frame of family capitalism. Today, generations have changed, managers are invited to lead the firm, or descendants, relatives of the founders. During the decades there was also a shift in how design is perceived, and what the roles the designer takes. The classic role of the designer-entrepreneur [*designer-imprenditore*] is challenged by this constantly restructuring scene. The designer-entrepreneur takes financial, managerial and organizational decisions, has and represents vision on design backed by a thorough knowledge and overview of all aspects and constraints of the firm. For innovating, and keeping/ raising the capacities to innovate firms rely on different strategies:

- open innovation
- acquire external management
- acquisition of other companies: developing an international/ global portfolio
- being brought under an umbrella of other companies
- inviting KIBS firms for innovation and design
- different partnerships with other producing firms [see chapter on open innovation for the borders of the firm revisited, and the detailed analysis of the case studies].

I also pointed out the different roles designers take and its implications on innovation strategies, from the designer-entrepreneur toward portfolio of designers, open innovation, relying on KIBS firms, or design table

DOI: 10.14267/phd.2016007

methodologies. I dedicated a special focus on different forms of open innovation and how they are related to modularization, thus how modularization creates entry points to innovate.

Despite that I have collected an extensive set of data, I relied only on some cases in this book that tackled different forms of production. Along with products, systems of products [kitchen] I included services [KIBS] to give a colorful picture, and to demonstrate the power of theory. My main findings [among others] point out that modularization serves:

- mass production, and economies of scope by meeting customized needs of consumers providing them with a range of opportunities to construct the product according to their needs. This trend has a broadening significance spanning across industries. Users become empowered to give forth their own vision on the final product. Customization does not merely serve the purpose of adjustment [for e.g. to given spaces] but for meeting an individual set of preferences: tastes, functions related to specific lifestyles.
- experimentation by creating platforms to innovate
- Broadening the range of products by lowering the costs of innovation and design of new products, benefiting from modular and architectural innovation.

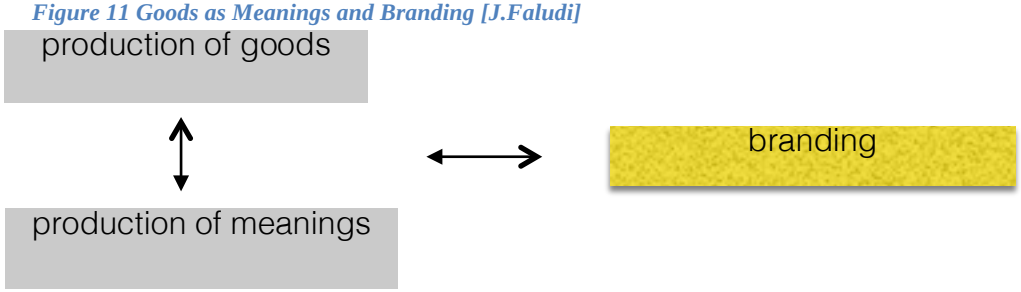
3.2. Implications: Transaction Costs, Openness and Boundaries of the Firm

Institutionalists traditionally approach the boundaries of the firm along transactions, where transactions represent unit of analysis [Coase 1937, Commons 1934, Williamson 1985]. Transaction costs theory structure the firm along the costs explaining hierarchy, vertical arrangements, decision on governance forms based on the analysis of costs. Ownership structure, and the vision of the firm as a nexus of contracts is also concerned about the division of tasks and flow of resources based on price mechanism that allocates resources [Coase 1937]. Knowledge-based theories of the firm draw the boundaries along capabilities and organizational routines [Nelson

DOI: 10.14267/phd.2016007

and Winter 1982, Levinthal 2000, Marengo and Dosi 2005, Brusoni and Principe 2001], rather than contracts or along the distribution of property rights [Grossman and Hart 1986, Hart and Moore 1990] and transactions. However these approaches view production as linear, as a sequence of stages. given that, Baldwin [2007] argues that knowledge and transaction boundaries are interconnected but not the same, therefore she suggests a network approach deriving from locating transactions within the net of production. Linking it to modularization, she argues that transactions are likely to be at module boundaries than in their interior. Dense task networks shall be located in transaction-free zones [reducing costs]. Modularity theory [based on research of capability theory and insitutinalists] contributes to understand firm boundaries from a different level: that of decisions, tasks and components to overcome the problem related to observe knowledge [Baldwin 2007, p. 162]. In this research however I didn't draw on Design-Stucture-Matrices neither carried out a network analysis of tasks and partnerships related to production, to test this model. I rather conclude on the importance of brands, bringing organizational configurations, the importance of sourcing in knowledge, reshaping organizational routines, and free revealing to innovate under one umbrella. I also add the perspective of visibility of a firm, and again strategic creation of brands, and the importance of communication of firms and their role in shaping the discourse. In this respect I stepped out of the frames of institutional and economic analysis of production and added the perspective of production of meanings and strategies of tapping meanings.

Figure 11 Goods as Meanings and Branding [J.Faludi]



DOI: 10.14267/phd.2016007

Furthermore, by analyzing technological innovation along with stylistic innovation, and viewing it as a holistic system of design and manufacturing of products I found that the boundaries of the firm lay on a conceptual level: the firm as core design concepts. Transactions in this respect arise while organizing and coordinating design, production, branding/marketing of production by conveying, and enforcing core design concepts during these tasks and ensuring that results are in line with the core design concepts.

Costs of openness are considered by scholars mostly those that are related to the risks of free revealing. Costs of intellectual property rights protection add up to innovation costs, while firms entail to benefit and to commercialize the result of innovation to that end.

There are also costs of [using the market: Coase 1934] marketing, branding, and making visible the result of innovation. What we learned from the case of Kitchen Becomes Open project, is that costs of free revealing of the outcome of the design were crowded out by the benefits of entering new fields of globally connected communities, and reinforcing the brand for communicating the core design concepts in a real-life open design process. [In addition, as said before, it created further entry points for innovation for maker communities, users, or anyone else, and raised capabilities of the firm by shared knowledge].

To summarize what Baldwin and von Hippel specified [2011, p. 1409] as transaction costs of innovation:

1. costs of establishing exclusive rights over the design [secrecy, and obtaining patent].
2. costs of protecting the design from theft: restricting access, enforcing noncompete agreements
3. legally transferring rights for the good/ service, and receiving compensation, protecting both sides against opportunism.

Licensing the product under Creative Commons, establishes the paternity, and visibility, creating a platform to innovate on. Open collaborative

DOI: 10.14267/phd.2016007

projects economize on these costs as they do not commercialize the output of the innovation.

Regarding the *dynamic transaction costs* [Langlois 1992], thus costs related to negotiating, persuading and teaching potential partners, in the case of established suppliers network these costs emerge only at the beginning of collaboration, thus later on we enter the realm of *thin crossing points* [Baldwin 2007], with shared encapsulated knowledge. This becomes very much similar to in-house development of solutions.

It might be also a viable path for companies to open up for raising capacities from time to time and invite third parties. In this case the *absorptive capacity* raises and reduces costs related to search and assimilation of solutions [Barge-Gil 2010]. Inviting third parties in forms of KIBS providers are in this line of economizing costs. KIBS firms providing innovation and design as a service are very keen on protecting intellectual rights, and keeping trade secrets, despite that they enter the level of reshaping organizational routines and capabilities [and raising absorptive capacity]. Companies relying on such services reduce their transaction costs of search and costs of openness by contracting global and well-known agencies.

There are obvious risks of design-copying, thus costs of opportunistic behavior of the partners, added to the costs of IPR protection. A design is quickly copied after product launch, as there are imitators within the population, as well as for-runners. Moreover, radical innovation might bring about a shift in the industry [for e.g. see the *5 stagioni* door of Valcucine which was produced by competitors for decades]. And there are also costs of being always ahead of the competitors.

Revealing the design prior to production bears the benefits of visibility [note that CC license prescribes that indication on paternity shall be indicated], it enters the world of global digital visibility [downloadable design]. In cases where the costs of development of a new design crowds out the benefits of revealing, companies follow closed, or more closed models [semi-open] schemes of innovation. This implies that the outcome

DOI: 10.14267/phd.2016007

will not be a public good, however third parties from a controlled net are invited to innovate.

The problem of modularization of production over a network of suppliers and the costs of protection of intellectual property rights can be overcome by *encapsulation of hidden information* within the modules [Parnas 1972]. The problem here is where to draw the boundaries of the modules in order to protect on one hand information that shall be kept trade secret, on the other to share as much as needed to most effectively break down the production into edible bites. Here the decision is taken on where and how much information it is inevitable and it pays off to reveal.

3.3. Toward Democratization of Design. The Role of Experimentation in Innovation

Although there was no space for an individual chapter, I still brought in the aspect of self-production and makers in discussing the ecosystem of design, illustrating with examples how different branches might cross-fertilize each other through open models of innovation, while exploring projects involving makers and designers in the realm of digital fabrication. However, I find this segment of the ecosystem extremely important and valuable for understanding the future perspectives of innovation and design [and framing my further research on the matter]. One reason to that is experimentation without the constraints that stem from the willingness to benefit from the outcome of the design.

Fablabs provide space and technology for joint creation and prototyping, sharing knowledge in community. Moreover, fablabs generate and accumulate knowledge provided both as a public good and service. Communities of makers work in collaborative innovation schemes producing work that is open-source. Along with products, applied technology and hardware are also improved and innovated on by communities of makers in digital fabrication. If design is democratized, thus anyone can freely enter and contribute along their needs, moreover the outcome of the design is a public good, as a consequence it will have

DOI: 10.14267/phd.2016007

long-term implications on the ecosystem of hardware and technology production. Open source technologies open the path for free experimentation, where the outcomes if recognized by a profit-seeker can be adapted and commercialized on. Furthermore, the outcomes of experimentation as well as the experimental approach of makers can contribute to other fields, or modes of production and design [for e.g. through open innovation projects].

The history of design has witnessed a shift from industrial design, and mass production toward low-scale production and even toward the concept of one piece-production, where the concept of design is detached from serving and benefiting from mass production and points toward the concept of joy and conceptuality. However, aesthetic value as core design concept of developing artifacts was always present in various conceptual framings. The actual configuration of this aesthetic value [beauty] tells us about the organization of production and industry behind it. According to De Lucchi:

> " one of the great merits of the Design Gallery has been its abolition of the series problem" as Richard Sennet the anthropologist says "…that craftsman should no longer be pictured in his medieval workshop, surrounded by apprentices carving one leg after another to make a chair. Rather he should be completely disconnected from the concept of production at the service of industry: the craftsperson is someone who does something in pursuit of a personal pleasure, backed by an emotive gratification." [Mendini 1993. p. 287]

This statement grabs the aspect of personal pleasure, and 'emotive gratification' from the perspective of the designer and designer's motivation behind, contrasting it with the utilitarian function of design, where the functionality of the object, and 'what can be sold on the market' aspect. Shall I conclude with these words to open up the perspectives toward conceptual approach to design and the industry behind it.

DOI: 10.14267/phd.2016007

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