

EMERGENT TRENDS IN THE DESIGN ECONOMY AND THEIR IMPACT ON CONSUMPTION, PRODUCTION AND DESIGN

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1. Introduction

Contemporary designers are working in an increasingly complex world, defined by constant technological, social, economic, cultural and environmental changes. Technological proliferation, digital diversification and growth of techno-dependency, transformed interactions, growing social activity and changed consumer behaviour together with problems like climate change, resource depletion, aging population, growing poverty, fluctuating economic conditions inevitably have an impact on design and pose multiple challenges to the profession. Under these dynamic conditions the concept of design has evolved from product-oriented towards solution-oriented one [Vezzoli and Manzini 2008]. Such holistic and innovative understanding requires fundamental redefinition of the nature of design, its context, principles and values. The focus of design thinking is shifted from the traditional consideration of products as the main point of interest towards systems and services, where the interactions between people, objects and environment stand in the foreground [Buchanan 2001], [Thackara 2005], [Vezzoli and Manzini 2008].

Addressing salient environmental, social and ethical issues, this new trend reflects the significant role design can play for discovery of new opportunities for solving problems and for creation of a more sustainable future. Designers contribute for this at a number of different levels – from strategic business planning and design management to conceptual design and design development of user-centred products and services [Thompson and Koskinen 2012]. This broader approach to design placing users and design processes at the heart of contemporary problem solving may offer a larger framework within which to pursue prosperity, well-being and resilience in the long run. Furthermore, the opportunities provided by the rapidly developing digital networks and communication technologies are blurring the roles between the actors involved in the design process – designers, producers and consumers, the latter becoming co-creators of products or services. Engaging users more directly into design activities sets a tendency in which users are transformed from passive consumers into active creators.

The paper presents an overview of the key factors shaping the new social and technological paradigm shift. It aims to identify the emerging agents of innovation (both social and technological), to describe the impact they have on design so far and to outline possible future perspectives. Research has been conducted in two steps: the first one involves literature review aiming to identify the driving forces behind the changes in design processes, having the potential to affect industry, commerce and environment. These include nascent technologies for digital fabrication (3d printing, Fab labs, nanotechnology, biotechnology) and collaborative practices (open design, co-design and co-creation, crowdsourcing, collaborative consumption). The second step is building a conceptual framework and short future scenarios describing the development of consumption, manufacturing and design

depending on the influence of the interrelatedness and interdependence of the identified factors. In conclusion implications about the role of design as a powerful instrument for harnessing these technologies and innovations are made.

Using the methodology of scenario planning we seek to explore how the future might unfold highlighting the critical points affecting the three sectors. These scenarios situated in the perspective of design are based on a screening process in the broader field of the global problems facing society in all types of human activities. They offer a structured way for thinking about the future and support adaptation to ongoing changes and challenges design is facing.

The research is orientated not only towards specialists involved in the sphere of design as product designers, interaction designers, user experience designers, graphic designers, service designers etc. but also towards people from a variety of disciplines and backgrounds including business strategists, marketing and branding managers, sociologists, psychologists, educators, etc.

2. Collaborative practices of the new economy

Collaboration is playing an increasingly important role in the economy of the 21st century. In the context of transformed economic, political and social systems into distributed networks, new models for value creation are emerging. The following section provides definitions of the collective-oriented processes which occur in the post-industrial society we live in. The described paradigms are a logical consequence of the socio-technical innovations and represent the observed deep changes in the business world.

2.1 Open innovation

Open innovation is a concept that emerged about 10 years ago. The term was promoted by Henry Chesbrough who states that: “Open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. This approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths to market during the Closed Innovation Era” [Chesbrough 2003]. The open innovation paradigm is opposed to the traditional model where innovation takes place only within the boundaries of the company and is closely connected to the emerging trends for user-centred innovation. Over the last decade many companies in the manufacturing sector have opened up the product-development process to new ideas conceived by suppliers, independent inventors, and university labs. The extent of adoption and pervasiveness of open innovation in large firms is constantly increasing. This is revealed in a recent survey, where 78 % of the respondent firms reported that they are practicing open innovation [Chesbrough 2013].

2.2 Co-creation

The concept of co-creation was introduced in 2000 by Prahalad and Ramaswamy as a new approach to innovation and involvement of the customer as a source of competence into value creation. [Prahalad and Ramaswamy 2000]. Roser and Samson [2009] propose the following definition: “Co-creation is an active, creative and social process, based on collaboration between producers and users, that is initiated by the firm to generate value for customers”. This new type of relationship between companies and consumers leads to the transformation of customers into active partners who co-create the content of their experience. Co-creation is distinguished from the other related concepts depending on the role of the company in the innovation process (consumer-led or producer-led) and the type of created value (standardized, customised or personalised) [Roser and Samson 2009].

2.3 Co-design

While co-creation has a more broad meaning, co-design focuses more narrowly on the process for creating products and services. “The concept of co-design is directly related to co-creation. By co-design we refer to collective creativity as it is applied across the whole span of a design process. By these definitions, co-design is a specific instance of co-creation” [Sanders and Simons 2009]. Design Council gives the following definitions of co-design:

- A set of tools used by designers to engage non-designers by asking, listening, learning, communicating and creating solutions collaboratively
- A community centred methodology that designers use to enable people who will be served by a designed outcome to participate in designing solutions to their problems
- A way to design a solution for a community with that community
- The process of designing with people that will use or deliver a product or service
- A partnership between designer, client and the wider community on a design project
- Collaboration on a design project between client, end-user, deliverer and designer
- The shift of design power from the client, via the designer, to the end-user
- Collective thinking and designing that addresses a community's issues
- Products or services that have been developed by the people who will use them in partnership with a designer
- Democratic design: A designer facilitating outcomes instigated by a community
- Research based design: A designer taking decisions and delivering solutions based on ideas / feedback from a community.

3. Emergence of a new design economy

Predetermined by the socio-technical circumstances of the rapidly globalizing and networked world design has become a decisive competitive advantage of business and management. “Fundamentally, at the heart of every good or service produced, sold and consumed is design” [Bryson and Rusten 2010]. Indeed, not only products that we use, but also the manufacturing processes thanks to which they are produced, the experiences we have while using them and the services they provide are result of design thinking. The three pillars on which the new design economy is founded are its social character – linked with the phenomena of social innovation, environmental re-orientation – leading to a green evolution and renewed territorial linkage, and technological innovation – supported by unprecedented technological breakthroughs [Meroni and Sangiorgi 2011].

3.1 Social character

The social aspect of the economy is characterized by its orientation towards meeting social needs of all kinds and the emergence of new social practices. Although the term ‘social innovation’ has no equivocal meaning the following definition clarifies its essence: “a novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals” [Auerswald 2009]. Examples of social innovation include establishing sustainable communities sharing facilities and reducing cost of living and their impact on the environment; promoting ecologically pure and healthy lifestyle through distribution of locally produced organic food; organizing social activities for elderly; providing alternative to the problem of urban communication through car-sharing and encouraging the use of bicycles; mutual exchange of services and skills among the members of a community; setting up training shops, etc. [Meroni and Sangiorgi 2011].

Central characteristic of social innovation is its value aspect. What is important about value creation is that it is no longer limited to corporations but it can come from the people who want to participate in the decision making of problems that directly affect them. Consumers are no longer mere recipients, they wish to take an active role in the production of valuable goods and services; they become ‘proactive consumers’ or ‘prosumers’ [Tofler 1980]. Although the term was coined back in 1980, it perfectly describes the participants of the Web 2.0 revolution. Another appropriate term for the new social category of users with altered behaviour and mentality is consum-authors [Chrometzka 2008]. Users, though they are not specially trained become the new design players, who experiment and develop abilities fast and turn themselves into producers of change.

Victor and Boynton [1998] define the emerging historically new type of work as ‘co-configuration’ – a system that can sense, respond and adapt to the individual experience of the consumer. It brings the value of customer-intelligent products and services which are created as a result of a constantly growing and evolving network between customer, product and company. Products and services are

'intelligently' linked to the customer's particular needs and evolve continuously to match them as they change in time. "With the organization of work under co-configuration, the customer becomes, in a sense, a real partner with the producer" [Victor and Boynton 1998]. Furthermore, enabled by social networks and social media platforms, users can cooperate, share knowledge and organize themselves and respectively create common value together. The importance of collaborative practices is increasing: peer-to-peer, disintermediation, wikis, platforms, collaboratives, open source, indeed open everything is the new lexicon of distributed systems [Murray 2009]. "By proposing alternative paths of value creation and sharing, these practices open new perspectives in terms of consumption, production and innovation models" [Bauwens 2012].

3.2 Environmental re-orientation

Another imperative for the new economy is its environmental re-orientation. The need to make careful choice of the materials and processes that are used in order to reduce the negative environmental impact of industry is widely recognized. Strategies for sustainable development include use of renewable resources and minimal use of nonrenewable ones (including bio materials, recycled and reused materials), minimizing the waste or transformation from linear to cyclic manufacturing processes, so the generated waste from one industry is used as an input for another, promotion of intergenerational as well as intersocietal equity, preserving ecological and human health [Garner and Keoleian 1995]. According to the convention to meet the needs of the present generation without sacrificing the needs of future generations, these key concepts should be applied at global, regional, and local levels. These environmental concerns require also "transformation in every part of the economy, from design and processing, to distribution and consumption" [Murray 2009]. At the level of products and services design, a systematic approach is needed to meet the ecological requirements. Life Cycle Design, Design for Environment, and other similar initiatives are emerging as systematic approaches for integrating environmental issues into the design process. They are "based on the product life cycle framework which considers the full environmental consequences of a product from raw materials acquisition through manufacturing and use to final disposal of wastes" [Keoleian and Menerey 1994].

3.3 Technological innovation

Technological breakthroughs play a critical role for the growth of the design economy. Innovations occur in two directions. The first direction concerns the development of platforms which allow new forms of collaboration and interaction between people, based on the peer-to-peer phenomena of Web 2.0. The second direction is about advance of radical manufacturing approaches, affecting the methods that objects are made with, the materials that are used and even the type of the objects that are produced. These technologies cause unprecedented changes which lead to the emergence of user innovation and open collaborative innovation which compete with and even replace the traditional manufacturer-centred innovation [Baldwin and Hippel 2009]. Enabled by existing technologies users can contribute actively to the design process and though they participate as autonomous actors they produce complex and highly competitive products and services. Key characteristic of this new form of production and innovation is that people contribute voluntarily with their personal knowledge and creativity, collaboration between them is not coordinated by markets and hierarchies and the produced goods and services are freely accessible to the public on the Internet [Wittke and Hanekop 2011]. Based on the complex interplay between social and technological innovations, emerges a new scenario, which Manzini names SLOC (standing for small, local, open and connected) [Manzini 2010]. This model synthesizes the specifics of the emerging economy with its distributed production and consumption systems, based on small, locally created entities interconnected in an open global network.

3.4 From design thinking to design acting

It is evident that a new design model is established where uneducated designers are involved actively in the design process on equal terms with the professionals. Each of these multidisciplinary participants coming with his diverse backgrounds and competences contributes to the creative solution

of the given problem. Collaboration and social interaction are crucial for the successful partnership between these very different actors in the development of innovative ideas. Managing their multiple perspectives becomes central in co-designing, therefore a shift in the focus from the individual to the collective is observed. In such a consideration of design as an activity taking place in a social context, creative solutions emerge as a result of discussion, deliberation and negotiation between the involved parties [Bucciarelli 2002]. It is exactly in this sense that in the process of innovation, design acting becomes an important part of design thinking. Design acting turns out to be that link bridging the gap between the classical design methodology and the business world, the dynamic interplay between the intuitive creative thinking and analytical thinking [Martin 2013], translating inspiration into implementation [Fraser 2006]. Typical for collaborative design practices is that users play a generative role through applying their own vision in designing the product or service. Within this framework design acting can become a powerful strategic tool empowering organizations to change their mindset and promote innovative solutions in a bottom up manner in pursuit of a leadership position in the global market.

4. Novel approaches to manufacturing

As pointed out by Bradshaw, Bowyer and Haufe, “Just as the democratization of information through personal computers was a key advance of the 20th century, the democratization of production through improvements in fabrication technologies will be a pivotal development in the 21st century” [Lipson and Kurman 2010]. The frontiers opened by personal manufacturing technologies have the potential to radically change the present norms of manufacturing and give design unthinkable hitherto possibilities. Consumers will be enabled to take product design in their hands and design, modify and make their own products for fun, or for their own personal use. The comparatively low cost of the equipment will allow small manufacturing companies to create custom developed objects and manufacture them on local basis. Since it is a form of open source innovation, development of own designs is not necessary as designers have access to the global base of open designs.

4.1 Personal fabrication

“Personal manufacturing machines, or “fabbers,” are the pint-sized, low-cost descendants of mass manufacturing machines used in factories” [Lipson and Kurman 2010]. These radical new manufacturing machines include 3D printers, desktop routing and milling machines, laser cutters, circuit makers and knitting and sewing machines. Among them 3D printers are the most popular type. In contrast to conventional methods which are based on subtractive manufacturing 3D printing is based on additive manufacturing. The technologies include laminated object manufacturing (LOM), selective laser sintering (SLS), photopolymerization (stereolithography, SLA), and fused deposition modeling (FDM) [Lipson et al. 2004]. The advantages of these technologies are ease of use, efficiency, high quality, recyclability, possibility to combine materials and to manufacture intricate and complicated shapes in different colours and textures, obtaining little or no waste, reduced lifetime cost, response to shorter product life cycles [Lipson and Kurman 2010].

4.2 Fab Labs

“Fab lab”, standing for “fabrication laboratory” or “fabulous laboratory” emerged as a combination of modern equipment and materials, connected by custom software for integrated design, manufacturing, and project management [Gershenfeld 2012]. Developed as a scientific experiment at MIT's Center for Bits and Atoms with the idea to bring digital fabrication to developing countries and remote areas lacking manufacturing capabilities, fab labs are already functioning in different parts of the world helping people to develop their own solutions to a variety of local problems. The process of turning ideas into products is so simplified, that anyone, even people lacking education in design and technology, is able to design and produce his personal customized products. The possibilities fab labs provide and their advantages for experimentation and implementation of an unlimited variety of applications make them full-fledged inexpensive factories with a lower environmental impact compared to conventional factories. Therefore their popularity is growing fast and it is not a chance that for a period of less than 10 years over 100 fab labs have been installed in more than 30 countries

around the world. Equipped with different tools securing every aspect of the manufacturing process - design, fabrication, testing and debugging, monitoring, analysis and documentation, users can make the desired tools and objects according to their specific needs [Mikhtiar et al. 2002]. Another strength of the technology is that all fab labs are interconnected allowing the realization of complex projects which could not be made otherwise except through sharing among them. Digitalization of the materials that are being used is a work in progress that will further revolutionize the field.

5. Scenario for tomorrow's design

Based on the assumption that future can not be predicted but only hypothesized, an opportunity scenario of a possible and plausible future is presented. Combined together the identified dimensions of change in the design economy serve as parameters for creating a scenario framework of how consumption, manufacturing and design might unfold in the future.

5.1 Consumers' world

Key words: open, connected, distributed, user-centred

The scenario depicts a personalised consumer world within a global co-creation environment. The focus is shifted from selling products to providing integrated product-service systems. The established trend towards individualisation of products and the integration of the customer into the design process continues to evolve. People are actively involved into the innovation process. Through network platforms, participating individually or collectively, they bring their individual perspectives to the discussed problem, share ideas and identify the best among them to turn into products and services. This strategy proves to be profitable not only for emerging small innovative companies but also for the big global players. To ensure that customers' needs would be fully satisfied, most of the companies rely on open design and that is the scheme behind the larger percent of the new products introduced to the market. Innovation is no longer happening in the R&D departments of the big companies. Instead it is outsourced to the crowd.

Thus people gradually begin to design their own product environment. Services are web-based and users have contributed for their improvement, customization and functionality. Consumers' expectations are extremely high, they demand short development time and high quality of products and services. Quality is expressed through the longevity, durability, adaptability and diversity of the products. Development of high value added product-service systems happens as a result of close user-producer interaction. Relationships are realized through advanced ICT solutions and occur throughout the whole product lifecycle.

5.2 The cyber factory

Key words: virtual, efficient, networked

The factory of the future responds perfectly to the changes of the global market and changed customers' needs and attitudes. It is characterised with digitalised production processes, high performance and flexibility. There are two types of factories – 'super factories', and small innovative companies, some of them home-located. The boundaries between virtual and physical world are completely blended. Product design is extremely complex, but production is very simplified as products are created and tested entirely in the virtual world. Data flow between different systems is smooth, enabling self-control and optimization of the manufacturing processes. Furthermore, factories are connected in an integral network system enabling the exchange of information so digital models can be easily transferred between factories around the world to find the most appropriate one to realize into practice the desired products.

Traditional and additive manufacturing continue to coexist. 3D printing is invaluable for the implementation of any idea into finished product. Except for bringing manufacturing closer to the user, it is eliminating the need for mass production, warehousing and distribution since products and spare parts are produced only on demand. Fab labbing is extensive.

5.3 Green economy

Key words: resilient, efficient, responsible, re-used

To be competitive on the market companies strive to be sustainable. Consumers wish to buy products and use services that are individualized but at the same time they expect them to meet high environmental standards. Designs are optimised to the highest degree to minimize the use of materials and resources in the production process, and to reduce waste in order to lower the negative impact on the environment. Fab labs and small companies established on a local base are very popular since they rely on local capabilities and resources. Generally applied systems for environmental life cycle assessment monitor every step of the manufacturing processes to the disposal of the products to ensure their environmental compatibility. Common use is preferred instead of ownership when possible as a means to reduce the amount of produced goods. Products designed for shared ownership are made more durable. Re-use and remanufacturing are common practices preserving much of the initial value of the products.

5.4 The role of design

The visualized in the above scenario new paradigm set by the socio-technical changes implies a corresponding change in the notion of design and the related role of designers. Traditional representation of design as concerned with the creation of products and services is further extended with the responsibility to solve a variety of social, economic and environmental problems. The Commission staff working document on 'Design as a driver of user-centred innovation' considers design as a strategic, cross-functional and multidisciplinary innovation activity. It also defines the designer as being part of a collective effort towards user-centred innovation, rather than an independent form giver [2009]. Designers are responsible not only for determining the shape of the objects and ensuring their functionality, but also for designing user experiences, establishing meaningful relationships between people and products, and delivering satisfaction on many levels. Furthermore, designers' task is made even more difficult by the fact that more people are joining the global network and together generate, develop and manage new ideas. Designers "become professional designers among many non-professional ones" [Manzini 2011].

Though users take more active part in the design process, the role of designers is very significant and their work should not be underestimated. They have the important mission to be facilitators of the co-design process, to challenge and stimulate the creative thinking of the other participating actors [Thackara 2005], [Manzini 2011]. In order to manage the growing complexity of the problems, strong interdisciplinary expertise is required. Developing the relevant tools to support creative collaboration is a central strategy for innovation and successful work within networked teams. For that purpose designers should possess communication and leadership skills. Acquisition of sound knowledge in science, engineering and materials is also critical for designer's capability to translate technical innovations into design solutions. Designers should be a kind of mediators between technology and users, science and commerce. Knowledge of the requirements for sustainable design is another factor for coming up with competitive, socially responsible and environmentally friendly solutions.

5.5 Application of the scenarios in theory and practice

The presented plausible model of the future development in the field of consumption, production and design is based on a multidimensional critical analysis of the economic, social, environmental and technological trends. Considering these issues from a broad holistic perspective, the key factors acting as agents of innovation were drawn. The selection of information in order to identify these factors has its own informative contribution because new knowledge from an environment external for design is introduced to its field. Subsequently the driving forces of change are synthesized and combined to serve as a basis for the creation of short scenarios for tomorrow's design. Giving insights about the paradigm shift in value creation in the design economy of the future, these scenarios can be useful not only for the theory and methodology of design science but also for design practice and design education. They can serve as planning tool for strategic development and guide for making effective solutions for the future. Understanding how and why consumption and production may evolve designers might benefit from these scenarios as they become more perceptive and more aware of the

multidisciplinary level of the role assigned to them within the social context they are working in. Regarding design education, the implications of the scenarios can be used for rethinking and modernizing the methods of teaching and even creating new disciplines and subjects meeting the future requirements and expectations of the design professionalist.

6. Conclusion

To generalize the outlined in the paper trends and their impact on design we can conclude that design is entering a dynamic new phase defined by the emergence of collaborative practices and novel approaches to manufacturing. Under these conditions progression is possible only through innovative thinking and change in the established patterns of consumption and production. As Einstein has said, “we cannot solve our problems with the same thinking we used when we created them”.

Main characteristic of the new design paradigm is the creation of value. It should be noted however that the concept of value has been re-defined. Web 2.0 technologies have enabled completely new means of collaborative value creation, referred to as Value 2.0 [Porta et al. 2008]. Indeed, we have already witnessed launched to the market products and services which have been suggested, tested and co-created by the collaborative effort of network communities. Besides getting actively involved in the design process, modern consumers are becoming more demanding than ever. They expect products and services to be personalized and tailored to their specific needs. This is made possible by the emerging personal manufacturing technologies. They not only allow experimentation with unattainable hitherto shapes and structures but also give new meaning to design through the opportunity of home use.

Within the context of these changed innovation and manufacturing models, sophisticated user demands and global competition, the following shifts of the design economy have been drawn:

- from passive to active
- from global to local
- from centralized to distributed
- from individual to common
- from professional to amateur
- from physical to virtual
- from closed to open
- from targeted to open to all
- from linear to networked
- from competitive to cooperative
- from mass consumption to mass participation
- from needs to values.

These interwoven trend shifts influence all spheres of life and create absolutely new requirements for the design process. To deal with the multifaceted challenges and to develop new strategies in the digital framework of the present, a different mindset is needed. It is necessary to reconsider the real values and direct the emphasis towards people and society as a whole. Designers have to engage more creatively and more responsibly and offer context-driven solutions on product, service and system level. Chosen approaches should be social-led and support the creation of an economy of services, experiences and sustainability.

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