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Collaborative and Responsible Innovation in the Packaging System Towards a New Normal

Innovación colaborativa y responsable en el sistema packaging hacia una nueva normalidad

Abstract. The crises that affect the planet at environmental, social and health levels open new scenarios and challenges for packaging system companies, an interconnected supply chain that is called to act in an integrated way and to innovate responsibly. The challenges they are called to face deal with distribution, new perceptions, people's health, and the well-being of the planet. In this document, it is argued that a co-Design and mediation platform, such as the *Observatory in Packaging Innovation*, based on collaboration and Design processes, can foster communication between the main actors of the packaging interconnected value chain (i.e. value web) and boost responsible innovation projects at a system level, with greater impacts than would be achieved separately. The packaging system is therefore defined as an integrated, collaborative, responsible network, a new model with shared value that works in collaborative projects, driven by Design and aimed at sustainability.

Keywords: Co-Design, packaging system, responsible innovation.

Resumen. Las crisis que afectan al planeta a nivel ambiental, social y sanitario abren nuevos escenarios y desafíos para las empresas del sistema *packaging*, una cadena de suministro interconectada que está llamada a actuar de forma integrada y a innovar de forma responsable. Los desafíos que están llamados a enfrentar se refieren a la distribución, las nuevas percepciones, la salud de las personas y el bienestar del planeta. En este documento se argumenta que el co-Diseño y la plataforma de mediación *Observatory in Packaging Innovation*, basado en procesos de colaboración y Diseño, puede fomentar la comunicación entre los principales actores de la cadena de valor interconectada del envase (es decir, la *value web*) e impulsar proyectos de innovación responsable a nivel de sistema, con mayores impactos que los que se lograrían por separado. Por consiguiente, el sector del embalaje se define como un sistema integrado, colaborativo y responsable, un nuevo modelo de valor compartido que funciona en proyectos de colaboración, impulsados por el Diseño y orientados a la sostenibilidad.

Palabras clave: Co-Diseño, innovación responsable, sistema *packaging*.

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1. By way of example, some of the measures undertaken and which have also involved the packaging system: UN Agenda 2030 for Sustainable Development, 17 SDGs (2015); Paris Agreement on Climate Change (2015); Single Use Plastic Directive and Green Deal (2019); Circular Economy Action Plan (2020); Plastic Tax and Sugar tax, Italy (2019); Law 16/2015 on the circular economy of the Emilia Romagna Region (2015).

Introduction

Centrality of Packaging at a Regional and Global Level

Throughout the centuries, the cultures of the Mediterranean have been based, among other things, on the circulation of goods and food, a need that has produced an unbroken thread of solutions and processes unfolding to this day, in which an articulated and systematic industrial sector is omnipresent in the life of industrialized populations. In this system, packaging represents the *quintessence* of mature capitalist behavior based on consumption, as well as the synthesis of an articulated and complex set of tangible and intangible facts through which goods (the merchandise) are brought from production to consumption (Celaschi, 2019).

Packaging, well beyond the mere function of *wrapping the goods*, is a complex artifact with multiple purposes, which have expanded over time. "It is an object of use (instrumental prosthesis), which makes it possible to contain the product, to protect it, to store it, to transport it and, at the same time, to facilitate its physical interaction with the user. Furthermore, it is a communication device (communication prosthesis), characterized by functions such as appellation, persuasive, informative and prescriptive, among others" (Ciravegna, 2017).

Packaging also involves countless different players throughout the supply chain: from those who deal with the procurement and research of raw materials, through transport, logistics, production, services, certifications, advertising, organized distribution, to the collection and disposal, waste-to-energy, recycling or reuse of waste from the system. A plurality of actors, with specific roles and complex relationships, that operate in an integrated manner and make choices that impact on the final packaging product, directly or indirectly. All these actors, relationships, disciplines give life to a *product system* that can be defined as a *packaging system* (Mauri, 1996; Ciravegna, 2017).

The *packaging system* is even more important in the Italian region of Emilia-Romagna where the University of Bologna and the Advanced Design Unit in which we are active are located. In fact, this region has earned the reputation of *Packaging Valley* thanks to its excellent expertise in this field: the best packaging automation machines for food, consumer products, tobacco and pharmaceuticals are designed and manufactured in this territory and exported all over the world. A district with a business of 3.1 billion, 170 companies, and 13 thousand employees where the top four players together are worth 50% more than the top four German players (Vesentini, 2012).

Responsible Innovation: a relevant goal in times of crisis

The environmental issue in the last five years has entered the center of the world scene, moving from *secret rooms* to squares (thanks to movements such as *FridaysForFuture* and *Extinction Rebellion*), helping a legislative boost first in Europe, then at national and global levels.¹

Although in the last few months the focus of every debate and research has shifted to the Covid-19 health emergency –a crisis that adds to the economic and social crisis that we have been facing for some years–, it was immediately evident how much the sustainability issue required even more attention and planning.

A WWF report (Pratesi, Galaveri & Antonelli, 2020) defines this kind of diseases as "the consequence of our impact on natural ecosystems" (p.4), and clearly traces how deforestation and wildlife capture open the way to species jumping, that phenomenon called *spillover* where a pathogen passes from one host species to another. For David Quammen (2012), the only solution is to quickly reduce the degree of our environmental degradation and reduce our demand for resources. According to Ilaria Capua², "This epidemic has highlighted how we are all interconnected beings. If you take action on an ecosystem and damage it, it will find a new balance, which can have pathological consequences on human beings" (Ronconi, 2020).

2. Director, Emerging Pathogens Institute of the University of Florida.

3. Automated commerce: drones and robotic vehicles for contactless distribution of goods or drugs.

4. Live streaming + e-commerce: assisted, interactive and real-time online shopping.

Therefore, if we want to guarantee the satisfaction of the needs of the present and avoid compromising the ability of future generations to satisfy their needs, we must learn to combine *profit* with *planet* and *people*. Far beyond the concepts of sustainability and innovation, we need to talk about an integrated system that needs to be thought in terms of *responsible innovation*: in other words, there can be no innovative project that does not cover the entire process, and does not redefine products and services by designing the original materials and their waste, and minimizing the negative impacts on the environment of the entire life cycle.

In the *Manifesto Recovering from the Pandemic with a New Green Deal for Italy* (2020), one hundred and ten Italian companies suggest to enhance "quality production, increasingly green production, an inseparable matter from the changes towards decarbonization and circularity" (p. 1).

This statement follows the paper by Hepburn, O'Callaghan, Stern, Stiglitz & Zenghelis (2020) in which more than 300 measures taken by the G20 countries in response to the pandemic are analyzed: only 4% of them are green (contributes to reduction of the greenhouse effect), while 4% are *brown* (contributes to increase the greenhouse effect) and 92% are *colorless*, bringing us back on the road to *business as usual*, a wasted lesson.

The concept of *responsible innovation* should therefore be understood "as a new approach towards innovation, in which social and ethical aspects are explicitly taken into account, and economic, socio-cultural and environmental aspects are balanced" (Blok & Lemmens, 2015, p. 20).

Packaging in the Covid era: new trends.

During the months of social distancing, goods and therefore packaging have often been the only contact point between us and the world and played a central and dynamic role. First, we have seen a rapid growth in *e-commerce* and *food delivery*, which has highlighted the need for digital and dynamic supply chains, also in the packaging industry. This point has many numbers that relate it: 100,000 new hires at Amazon, the emergence of new businesses (like the first Italian supermarket exclusively online), the emergence of trends such as *subscription boxes* and the advent of starred chef's dishes at home.

These mass phenomena, together with new trends such as a-commerce³ and shop-streaming⁴, open new opportunities and new Design/environmental/



Figure 1 . Nomisma Observatory Data on Italian Consumption during Lockdown.

Source: authors' elaboration.

5. A survey carried out by Nomisma –a company that carries out market research and consulting services for companies, associations and public institutions– designed to examine the mood, consumption and desires of Italians in quarantine.

logistics issues: how should delivery approaches be scaled up? How to redesign disposable, often non-recyclable packaging? How to optimize distribution? How will people, software and robots work together? These are some of the questions that this crisis has raised, and where this research is focused.

The second point that emerged during lockdown concerns the change in perception of *hygiene* and *health issues*. The packaging no longer appears to us as a challenge, something to reduce or remove, but as protection and an assurance of hygiene. The rise of bulk products and the promising attempts to replace the disposable packaging product with the durable packaging service (e.g. Terracycle's Loop and numerous refill and reuse services) now seem to be questioned. A scientific study (Doremalen, Bushmaker, Morris, Holbrook, Gamble, Williamson, Tamin, Harcourt, Thornburg, Gerber, Lloyd-Smith, Wit & Munster, 2020) concludes that the virus can survive 24 hours on cardboard and 72 hours on plastic: could the packs therefore be a shield for the content but a means of diffusion as a container? It is not entirely clear. An even more recent study (*Health Expert Statement*, 2020), signed by 115 health experts from eighteen countries, guarantees retailers and consumers that reusable products are safe during Covid-19, rejecting complaints from the plastics industry.

In this particular transition period, packaging has been invested with new communication functions (e.g. labels in China with the name and temperature of the person who handled the packaging (Zhimeng, 2020), or the trustDelivery app that with QR code guarantees the security protocols in food delivery) as well as new functional features, e.g. the shield distributed by the Chinese food delivery company Meituan, a box to put around the plate and head while eating (Kharpal, 2020). These cases show how the transformation of our reality is also having an impact on packaging. The Nomisma Lockdown Observatory⁵ also notes that the Covid-19 emergency increased consumers' attention to health and well-being (Figure 1).

In this complex scenario, it is good that packaging companies have put themselves at the service of the emergency by converting their production capacity to guarantee gels and masks, but the test to be passed is wider and raises other questions: what role do packages play in protecting content and consumers? What impact does this have on the environment?

It is a matter of redesigning the companies themselves to be ready for the many new challenges that this emergency and other social, environmental, and economic problems have opened up. The companies in fact need to innovate responsibly and in a systemic way, connecting the new needs of people and those of the planet within their business.

With this paper we argue that, in such a challenging context, co-Design could foster collaboration among the different stakeholders of the packaging system. Moreover, we believe that this process would be empowered by mediation platforms that facilitate and communicate, identify needs, share knowledge and inspiration, and boost responsible innovation projects at a system level. We propose the development of the *Observatory in Packaging Innovation* as one of these enabling platforms.

Methodology

The role of Design in the packaging system

Being the crossroads of different skills and functions, the packaging system cannot live without *Design* to keep them together, a mediator know-how between the interests of the production system and those of consumption, between knowledge and disciplines (Celaschi, 2008), between man and the environment. Through Design is possible "observing reality, making concise and transformable models of reality, and then transforming the assessed models into reality" (Celaschi, 2008, p. 29). Reducing complexity by scale, without losing sight of the identifying elements of the problem, allows you to manipulate it: "Knowledge is the basis of good design" (Celaschi, 2008, p. 29).

We can define Design as an innovation process capable of anticipating the needs and putting the user at the center (Celaschi, 2016), and therefore as a driver for responsible innovation in the packaging system. Design in fact:

- Is an enabling factor to redesign products with a view to circularity and environmental sustainability: from reducing the number of materials to simplifying and disassembling them for easy recycling, everything can and must be designed. The SUP Directive, the European Green Deal and the Circular Economy Action Plan clearly define the need to "mobilize industry for a clean and circular economy" (European Commission, The European Green Deal, 2019, p. 7), and support circular Design, because "up to 80% of the environmental impact of products is determined at the design stage" (European Commission, A new Circular Economy Action Plan, 2020).
- Is an enhancement tool for an innovative packaging industry. The packaging can be functionalized with digital technologies in order to obtain traceability, intelligence and interactivity services, serving both the company and the consumer, as well as the environment.
- Is a means to improve the potential of packaging as a medium of communication for a sustainable culture. Real change needs to invoke the responsibility of individuals (governments, industries, civil society), but for this responsibility to be possible it is necessary to spread correct information and proper knowledge. By reducing the scale of complexity, Design can help to spread an adequate awareness on an articulated theme.

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From the research to an Observatory in Packaging Innovation

The main insight of this paper comes from a process we have tested and used in recent years at the Advanced Design Unit of the University of Bologna. It is about gathering and interviewing experts on a topic (which we will call *observers*) to collaborate in the search for data and reporting of case studies. The results of this survey are then brought to the attention of a wide audience thanks to the organization of a *Symposium*, where we disseminate the results and give space to a selection of case studies as well as invite other experts to the discussion. This *Symposium* event helps the creation of an enlarged network on the topic, which will be the basis for the construction of an Observatory on the topic itself, i.e. a body that will continue to monitor developments on the subject over time.

#MAIN DRIVERS #DESIGN ALERT

1.

(New) Materials are gold

The design of packaging materials should take into account infrastructural and ecosystem aspects.



2.

Closing the loop

The packaging circular design should take into account gains and pains of all players in the process.



3.

Shaking the value chain

The packaging, as a vector in this value-network, has to become chameleonic (adaptable, customizable, refillable).



4.

Logistic Thinking

Packaging should be designed to maintain or improve logistics efficiency.



5.

Talking Package

Packaging should be designed as "digitally native"



6.

Packaging as a Channel

Packaging should be designed as a powerful mass-medium



Figure 2. Drivers and Design Alerts in the Packaging System.

Source: authors' elaboration.

6. The group of observers was composed as follows: ten universities, seventeen companies, five design firms, five consortia/institutions, more than twenty freelance/designers.

We have adopted this model (Reports and Research > *Symposium* > Observatory) also on the theme of innovation and sustainability in the packaging system.

In fact, during 2019 we coordinated qualitative-quantitative research that in six months collected more than 300 cases of packaging innovation reported by an international network of observers⁶. In December 2019, the 1st International *Symposium* on Innovation called "The Future of Packaging Design. Toward a Smart and Sustainable Era" was held in Bologna to disseminate the results of the research and start creating a network of experts on the subject.

The aim of the event was also to create in the region an *Observatory on Packaging Innovation* that, starting from the sensitivity of Design, would bring together the knowledge of the various scientific and technological sectors involved in the supply chain (companies, research centers and universities, government administrations, consumer groups associations), to create an organization capable of collecting, processing and conveying knowledge and experience for the rapid dissemination of innovation in the sector. In our vision, this hub is able to design and strengthen relationships and would represent an excellent trigger for new collaborative projects towards sustainable innovation.

This Observatory has continued to work synergistically with all stakeholders throughout these months, and this work has produced data and results that are the basis of the thesis supported in this document.

Co-design as an enabler in the value web

From the research "The Future of Packaging Design" (Celaschi, Giardina, Ciravegna, 2019), six interconnected drivers of innovation have emerged (Figure 2). Even if a lot of things changed during the pandemic, we can consider most of them valid post-Covid. For each of them we have also reported a *Design Alert*, which is meant to be the *actionable insight* for the packaging Design industry, the deepening that translates the driver into concrete actions.

MAIN AREAS OF CASE STUDIES



SPECIFIC FEATURES OF CASE STUDIES



Figure 3. Main areas and specific features of case studies.

Source: authors' elaboration.

7. "Operator producing or packaging both for himself and for other industrial or commercial users" (p.107).

8. Consider the impossibility of converting some waste into second raw material from a legislative point of view.

More than half of the 325 recent global cases developed mainly in Italy, Europe and the USA, focus on eco-materials, the remaining instead shape & functionality, and smart solutions. A great deal of attention emerged on the broad issue of sustainability (Figure 3).

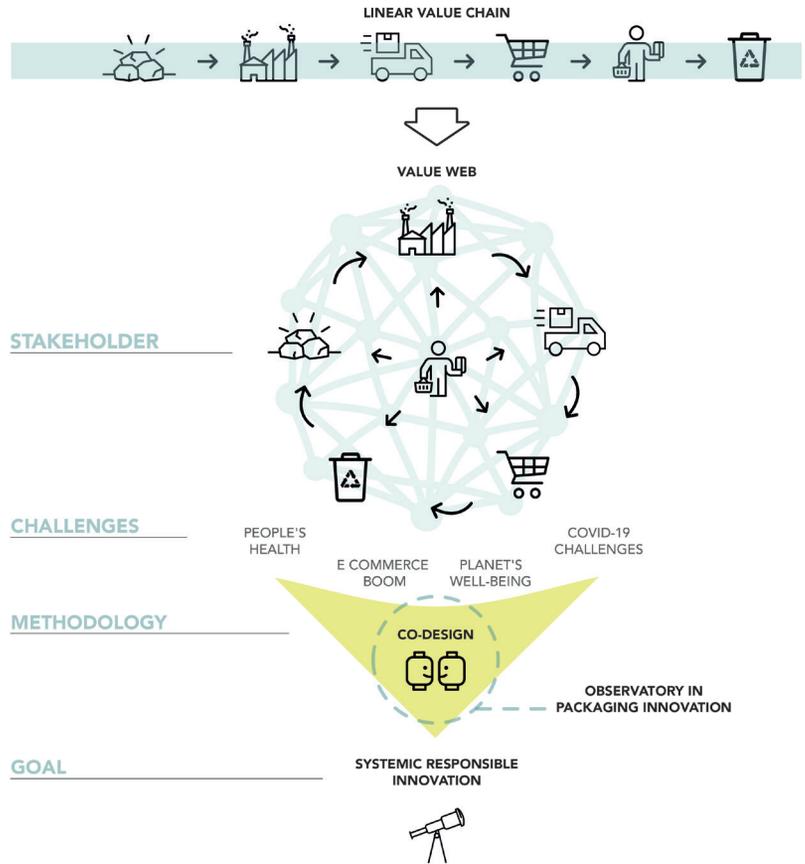
The main drivers that emerged in the study were: the focus on low-impact materials, the theme of circularity, the new role of logistics, the digitization, the role of packaging as a channel for social or environmental messages, and the change in the packaging value chain, also referred to as *value web* (Bouwman & Janssen, 2010) because it is no longer linear, but interconnected. In fact, we observed a shaking of the packaging supply chain that opens up new roles for the actors involved and for the packaging itself, which must become customizable, adaptable and accessible in different ways. The research has highlighted another element: the importance of *collaboration* between the actors of the supply chain (no longer linear), a shared participation that is necessary especially in projects aimed at circularity and sustainability, where the active role of the consumer and co-participation are essential for the success of the projects.

This observation also leads to a first challenge: in the packaging sector, the *competition* is not only between different brands owners, but also between other players in the same chain, such as co-packers⁷ (Bucchetti & Ciravegna, 2009) or retailers owning *private labels*, sold in their stores in competition with other brands.

The dialogue between actors with different interests can be win-win for everybody. It is undeniable, for example, that some fundamental actions to redesign circular processes are not possible without targeted policies⁸. In addition, concrete actions for responsible innovation by companies are often held back by a gap in consumer awareness, and can face issues in waste management due to structural, administrative and communicative causes.

As Richard Sennett says, cooperation is a tendency present in our genes, but at the same time it is a capacity that must be exercised, developed, deepened,

Figure 4. Value Web and Co-Design towards Systemic Responsible Innovation Goals.
 Source: authors' elaboration.



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learned from time to time. Collaboration is a capacity often intertwined with competitive elements, but that also emerges spontaneously in social life, where there are conditions that allow people to recognize each other's abilities and limitations and to adapt to them progressively (Sennett, 2012).

Even in the complex and articulated context of the packaging system, the *co-Design* which is based on collaboration, can be an enabling factor for the main actors of the value web to define common focus areas of responsible innovation, and to face their current and future challenges, such as the evolution of e-commerce, people's health and the well-being of the planet, but also the new challenges emerged with Covid-19 (Figure 4). The *Observatory in Packaging Innovation* would form the basis of relationships and knowledge preliminary to develop these co-Design projects.

"Co-Design means that people come together to conceptually develop and create things that respond to certain matters of concern and create a (better) future reality. People come together despite, or because of, their different agendas, needs, knowledge and skills" (Zamenopoulos & Alexiou, 2018, p. 12).

In the context of responsible innovation, the systemic approach of the supply chain and the collaboration between subjects obtains results that have greater impact than those that would be obtained individually, despite its difficulties.

9. "What will wake the team members up every day and make them want to go where they're dreaming of going?".

Ideally, this type of project should involve four types of stakeholders: companies in the supply chain, research centers and universities, government administrations, and consumer groups associations.

The criticalities inherent in the collaboration between competing subjects can be overcome with a methodology based on two tools:

- The purpose-themes: responsible innovation at a system level, even post-Covid, is essential for everyone, a sort of *neutral* theme beyond the logic of competition that can only be achieved by collaborating. For a team to be motivated to collaborate, a high *purpose* is needed, which is leverage and glue for collaboration (Nayar, 2014)⁹.
- Long-term collaboration: co-Design helps to overcome competition as a suitable method to build projects with balanced costs/benefits for all. In addition, the prospect of collaboration and long-term benefits will fuel a virtuous circle (Benavides, De Eskinazis & Swan, 2012).

Results

A Global Observation Network towards applicable solutions: case studies, enterprises, widespread knowledge

The *Symposium* held on the theme of packaging innovation and sustainability ("The Future of Packaging Design. Toward a Smart and Sustainable Era") produced meaningful results in quantitative terms both within the research and with the network created.

The results of the research were illustrated during the event, in the presence of over 250 participants and with the coordination of a scientific commission, which included three universities, in addition to the University of Bologna. Six global experts on the subject have been called together with seven important companies operating in the Packaging Valley of Emilia Romagna that introduced the innovations they have recently carried out.

More than 80 international observers contributed to collect 325 cases, developed mainly by B2B and B2C Companies or start-ups (but also universities and research centers) in the three-year period between 2016 and 2019. With regard to geographical locations, 108 case studies were developed in Italy (40 from Packaging Valley alone), 110 in the rest of Europe, 84 in the USA and 23 in the rest of the world.

Several players of the packaging system confirmed their interest to join an Observatory on Packaging Innovation: 9 consortia and public institutions, 6 research centers and Italian/international universities, 38 companies along the entire packaging value web, and more than twenty researchers and professors.

The *Symposium* also helped to develop an overall packaging system stakeholder network in the Packaging Valley –the base for the Observatory– of over 450 people. Over the last six months, the Observatory has continued to monitor the network and innovations, conducting another survey in May 2020, with a focus on what was happening in the packaging sector in

relation to the current pandemic. Over 130 new case studies were reported, half of which have references to e-commerce, hygiene, or to the production conversion adopted by companies to support the emergency.

Collaboration in responsible and innovative projects

We have therefore argued that co-Design enabled collaboration is a crucial factor for the development of responsible innovation projects, which by their nature can only proliferate where responsible actors from different areas (political, economic, social, environmental) work together to address common challenges and high goals, going beyond the logic of market competition.

Below we report some example of the effectiveness of collaboration in worldwide cases oriented to responsible innovation, developed in different companies:

- Cisco Connected Goods project, in which traceability plays a crucial role for the circularity of the product, guaranteeing the right information to the right actor throughout the entire cycle.
- Closed Loop Partners, an investment company based on an ecosystem of entrepreneurs, experts, companies, institutions, and municipalities to align profit with a positive social and environmental impact. The NextGen Consortium, led by Closed Loop Partners and founded by Starbucks and McDonald's in an unprecedented pre-competitive partnership, is committed to advancing food packaging solutions, tackling disposable food packaging waste and finding scalable solutions that bring value to global recovery systems.
- G4R project, one of the finalists for Best Packaging 2020 prize: a stand-up envelope for the dairy sector that is functional, interactive and with antibacterial properties that increase shelf life, the result of the Gerosa company's collaboration with seven other companies of the supply chain.

All these projects have a shared purpose that works as a glue and facilitates dialogue. We believe that knowledge sharing of the Observatory can be the prerequisite for the creation of a common language, and the first step for the definition of common goals and collaborative projects of responsible innovation.

Discussion

An integrated, collaborative, responsible system

As argued by Blok and Lemmens (2015), collaboration and responsible innovation are indeed closely interconnected.

"Because the primary responsibility for economic, socio-cultural and environmental aspects is allocated to different players in society - the profit sector on the one hand and governmental organizations, NGO's and civil society on the other - it is argued that the balancing of *People, Planet and Profit* in sustainable business development presupposes the active involvement of and partnership with various elements of society. These partnerships are also crucial from an innovation

perspective per se. Nowadays, it is widely acknowledged that only a few firms have all resources and networks available to innovate in isolation. Innovation seems to flourish in an open innovation environment, in which the interaction with various stakeholders is seen as a resource of competitive advantage. From this perspective, it can be expected that cross-sector partnerships with multiple stakeholders will lead to innovative *and* responsible solutions” (Blok & Lemmens, 2015, p.20).

It becomes clear how co-Design practices can be an excellent lever to achieve responsible innovation objectives, in order to face the challenges that the current crises create, facilitating cooperation between all the actors around the packaging system: not only business companies, but also government administrations, research centers and consumer associations, etc.

Talking about the packaging system during challenging times like today's, we need to think about it as an integrated, collaborative, and responsible network. In this kind of integrated system all the actors –companies in the value web, those responsible for policy making in government administrations, associations representing consumers and vulnerable groups, universities and research centers– are active participants in the co-Design process in a sort of *neutral space* to create shared value, which is assumed as higher than the sum of individual outcomes.

Below we present an example of a typical process in this collaborative system model, driven by Design and aimed at sustainability:

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- The challenge can start from any company in the sector: brand owner, semi-finished product manufacturer, material producer, disposal/recycling company, etc. and can be shared with other stakeholders to be refined.
- Co-Design sessions will allow a greater understanding of stakeholders' needs, and the proposal of a work plan that goes beyond competition, on issues of common interest (e.g. achieving one of the European recyclability targets, starting circular economy production processes, reducing the ecological footprint of a product, etc).
- Concept creation and scenario building allows the players involved to evaluate all possible solutions, highlighting the pains and gains of each proposal.
- The selected solutions will then be iteratively prototyped, tested with stakeholders and refined in a collaborative environment.

In this typical co-Design scenario it is possible to reach solutions that are feasible, sustainable and desirable, open to a responsible change (innovation) in which all elements are balanced.

Conclusions

Changing vision on the packaging sector towards a new normality

In this new perspective, a collaborative packaging system model will improve the *resilience* of the system itself in facing the current crisis and all the possible new challenges that a future with uncertain prospects could bring, because it aims to create a solid body capable of acting in an integrated manner for innovative and responsible solutions.

In conclusion, this model will also bring specific benefits distributed among the individual players of the value web, which we could summarize as follows:

- It will allow enterprises to have a greater knowledge of the advantages and opportunities of systemic responsible innovation, increasing their skills, their knowledge of consumer needs, their ability to identify new partners and to dialogue with government administrations.
- It will foster the exchange between businesses, citizens and government administrations for the implementation of more effective and purpose-oriented policies, improving the reputation of institutions as creators of value and support for innovation.
- It will promote the role of citizens as *prosumers*, aware consumers in the search for innovative, responsible, inclusive solutions.
- It will improve the real impacts of research, its ability to make technology transfer, to be a lever of innovation and a disseminator of knowledge and awareness on systemic responsible innovation issues.

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