

## **Integrated Framework for Circular Economy Through Open Innovation in Business Incubators: An Research Agenda**

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**Abstract:** *This article aims to contribute to a policy of innovation in the field of Circular Economy (CE). To do so, it presents An integrated framework for the CE based on open innovation (IOP) practices towards sustainability. Finally, an agenda for future research were presented. The research was addressed to Italian business incubators (BIs). The proposal was elaborated from the specialized literature and validated externally by specialists. The validation was through a questionnaire sent via email. The produced results were satisfactory, validating the presented proposal. This research started with a gap in the literature on this object. It is hoped that this research can contribute to state of the art and the state of practice. It is also hoped that this research may illuminate the spectrum of decision-making for a complex subject with few studies on the subject, but with a relevant agenda for society. OIP represent substantial advances in building innovation to support business models for CE and achieving sustainability in BIs. Evidently, there are still issues to be deepened in other studies of the kind. And for these new studies it is expected to have made some contributions, especially in the methodological field, which can still be explored. It is believed to have been able to highlight the importance of applying innovative tools and methods when planning complex systems such as CE.*

**Key words:** *Circular economy business model; Open innovation practices; Sustainable performance*

### **1.Introduction**

Recently, the circular economy (CE) has gained prominence among researchers and professionals because of its potential social and environmental benefits (Agyemang et.al., 2018). In addition, as CE and sustainability gain greater attention of governments, industry and academia, business model innovation for circularity and / or sustainability are becoming increasingly essential to achieving competitive advantages for companies (Pieroni, McAloone, and Pigosso, 2019). To Morseletto (2020), CE can be defined as an economic model, with the objective of efficient use of resources by minimizing waste, retaining long-term value, reducing primary resources and closed product loops, product parts, and materials within the boundaries of environmental protection and socioeconomic benefits (Murray et al., 2017; Babbitt et al., 2018; Hofmann, 2019). Kravchenko, McAlloone, and Pigosso (2019) argue that CE is often seen as an opportunity to achieve sustainability, which presupposes the implementation of not only financially beneficial circular strategies, but also environmentally and socially valuable ones

In this spectrum, Mostafa and Negm (2018) argue that innovation is a driver for the successful implementation of sustainability [...] (Garcia-Alvarez, 2015); and the incorporation of organizational sustainability into the business environment requires considering the environmental, economic, and social performance indicators into the management activities and evaluation processes (Milne and Gray, 2013). Thus, the integration of sustainability and organizational innovation can [...] stimulate the creation of better goods and services that meet the needs of customers, which makes organizational sustainability a strategic choice (Mostafa and Negm, 2018). "The external search for information and its integration in the context of open innovation is one practice that can lead to increased success" (Rauter et.al., 2018). According to Rauter et.al. (2018), the important role of the search for and integration of external knowledge in a corporate's innovation success has been widely acknowledged (Stefan and Bengtsson, 2017). This means that organizations must face their new products and services using in addition to internal knowledge, it is necessary to encourage innovation beyond the organization's borders along its supply chains and other sources, such as universities, research centers [...] (Mostafa and Negm, 2018). Thus, according to De Battistella, De Toni, and Pessot (2016), the open innovation paradigm (Chesbrough, 2003) represents a valuable perspective for firms to open up their innovation process leveraging both internal and external sources of knowledge and expand the potential to realize new business opportunities (Chesbrough and Rosenbloom, 2002). On the other hand, Lyu et.al. (2019) describes open innovation practices (OIP) as behaviors and processes by which companies use external knowledge and technology to promote their innovation results and maintain competitive advantages (Bianchi et al., 2011; Chesbrough and Crowther, 2006). In summary, it must be borne in mind that sustainability can only be achieved with social and environmental priorities. And in this spectrum, open innovation can be a strong ally.

This presupposes balancing OIP, CE and sustainable performance and must be guided by the theoretical references of contemporary thought that accompany the determinants of experiences oriented to sustainability. Thus, this research aims to present an integrated framework for the EC business models from the IPOs towards sustainable performance. This framework is based on the CE model from The Ellen MacArthur Foundation (2015), on principles (The Ellen

MacArthur Foundation, 2015): Regenerate, Share, Optimize, Loop, Virtualize, and Exchange - together, the ReSOLVE framework.

There is a gap in the integrated framework for OIP and CE that leads to sustainable performance. This research is addressed to business incubators in Italy. BIs are expressive for their ability to boost entrepreneurship and innovation, in addition to promoting economic development and job creation (Auricchio et.al., 2014). Battistella, De Toni and Pessot (2016) refer that BIs support and accelerate the creation of new entrepreneurial companies, offering them access to external networks of partners and resources (Pauwels et al., 2015). According to Scillitoe and Chakrabarti (2010), the fact that a company is located in an open environment of an incubator is one of the main factors that affect the success of its survival, sales and employment growth and new collaborations (Battistella, De Toni and Pessot, 2016). In this spectrum, BIs must promote sustainable entrepreneurship. To kardos (2012), “Sustainable entrepreneurship obtains main characteristics such as social responsibility, competitiveness, progressivity, creation and use of knowledge, capacity for innovation, dynamism and seeks commercial benefits, creating social value” (Krisciunas and Greblikaite, 2007).

It is hoped that this research can contribute to planning policy for circular models in Italian BIs, and has key questions:

- **RQ1.** How do open innovation practices impact the sustainable performance of BIs mediated by circular business models?
- **RQ2.** How do circular business models affect the sustainable performance of BIs in Italy?
- **RQ3.** How do knowledge sources for OI affect sustainable performance mediated by CE business models at the level of BIs in Italy?

It is also hoped that this proposal can contribute to overcoming some barriers found in the implementation of some initiatives for CE in the light of the experience of some Italian companies and serves the lessons learned for BIs (Mancini and Zampetti, 2019):

- Inadequate and contradictory legislation
- Fear of the change process
- Absence of incentive strategies
- Customers unwilling to make efforts to explore the EC
- Little trust from suppliers
- Lack of inadequate capital
- Difficulties in knowledge channels
- Uncertainties regarding economic return and costs
- Lack of technological skills

Our work develops into five sections. In Section 2, we are describing a research framework integrating OIP and CE business models. In Section 3, we outline our Integrated Framework: COIP and CE. In Section 4, Finally, in Section 5, we present our Implications, research agenda and conclusion

## **2. Research framework integrating OIP and CE business models**

### **2.1. Conceptual Model framework: Constructs and propositions**

In this section we present the integrated proposal between OIP, CE and sustainable performance based on ReSOLVE from The Ellen MacArthur Foundation (2015), This structure was elaborated from the specialized literature and validated externally by (10) specialists, selected by technical and scientific criteria , with experience and knowledge about this object, such as: formulators of public policies; government managers; managers of non-governmental organizations; incubator managers; university researchers; among others. As already mentioned, the research is oriented towards BIs in Italy, which have stood out as mechanisms that promote and encourage entrepreneurship, innovation and economic development (Auricchio, et.al., 2014). On the other hand, Italy has been a pioneer in actions for the CE, with some initiatives [...] (Ghisellini and Ulgiati, 2020). To Sehnem, Pandolfi and Gomes (2018), the objective of the EC is a substantial increase in the circularity of resources in production service patterns within an economic system (Manninen et al., 2018), as well as increasing the efficiency of resource use (Ghisellini et al., 2016; Tukker, 2015), and with the objective of balancing economy, environment and society. Thus, this section examines the conceptual model (Figure 1) and presents the propositions to be tested throughout this work. From this framework integrating OIP, CE and sustainable performance

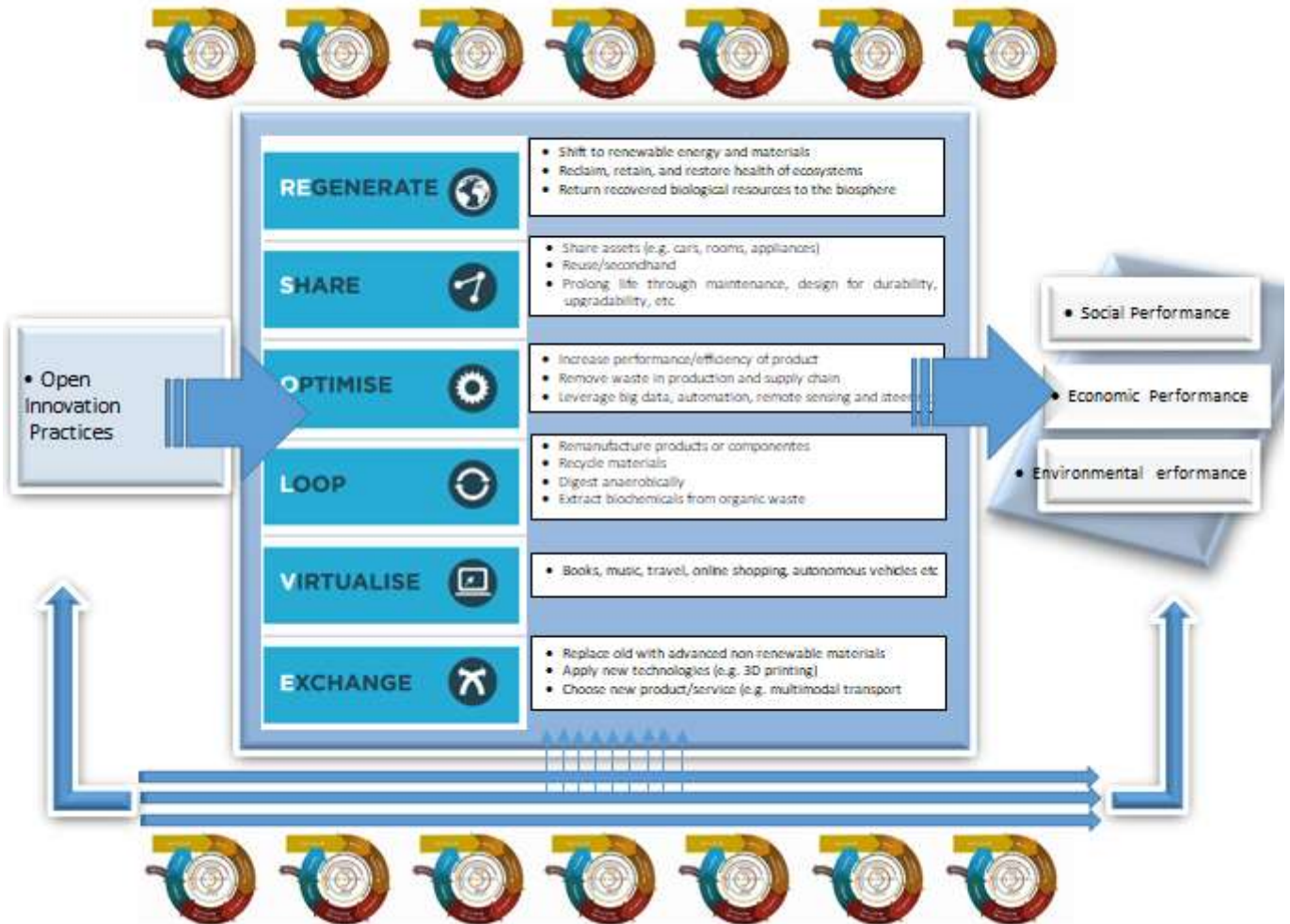


Figure 1: Integrated Framework (OIP-CE) (based on The Ellen MacArthur Foundation (2015) and European Commission (2014))

Lyu et.al. (2019) argue that open innovation (OI) assumes that firms use both internal and external knowledge to advance their technological skills and improve innovation performance (Cheng and Shiu, 2015; Chesbrough, 2003). According to Lyu et.al. (2019), The OI practice "describes the behaviors and processes by which firms use external knowledge and technology to foster their innovation outcomes and maintain competitive edges" (Bianchi et al., 2011; Chesbrough and Crowther, 2006). According to Santoro, Ferraris, and Winteler (2018), by leveraging strategic knowledge through external open innovation sources (OIS), such as customers and suppliers, and establishing open innovation practices (OIP), such as licensing-in and R&D alliances, firms can foster competitive advantage by developing innovative products and services quickly and at lower costs (Laursen and Salter, 2006; Barge-Gil, 2013). Rauter et.al. (2018) suggest that it is essential to involve partners directly associated with the company, such as customers or universities, and other stakeholders in the broad ecosystem, such as intermediaries or NGOs who might have mutual interest in improving the outcome of companies, particularly with respect to sustainability.

CE is based on three principles: (a) reservation and enhancement of natural capital, through actions and control with a view to renewing renewable flows; (b) optimization of resources through the circulation of products, components and materials with maximum use, both from a technical and biological perspective; and (c) promotion of system effectiveness by revealing and designing out negative externalities (The Ellen MacArthur Foundation, 2015). Based on these principles, six business actions are presented (The Ellen MacArthur Foundation, 2015): Regenerate, Share, Optimize, Loop, Virtualize, and Exchange - together, the ReSOLVE framework. This framework for CE is oriented towards economic development, without losing social and environmental focus. It is the order of the day to reduce waste or disposal without any residual utility, reuse, resource recovery, reuse and recycling, increasing product durability, which presupposes the product redesign and the process redesign.

In this spectrum, according to Hernández and Carrà (2016), BIs can be seen as facilitators for sustainable development [...] (Schwartz and Göthner, 2009; Bruneel et al., 2012). Banihashemi, Fei, and Shu-Ling Chen (2019) describe the performance of sustainability as follows:

- Environmental performance of an organization is considered as its capability to contribute to reductions in air and water pollution and solid waste, and its ability to reduce consumption of harmful, hazardous, and toxic materials and the frequency of environmental accidents (Zhu et al., 2008).
- Economic performance of an organization mainly focuses on its profitability and growth (Judge and Douglas, 1998).
- Social performance is defined as “a business organization’s configuration of principles of social responsibility, processes of social responsiveness, and policies, programs and observable outcomes as they report to the firm’s societal relationships” (Wood, 1991, p. 693).

In our understanding, innovation and knowledge can leverage new circular business models, which can result in superior sustainable performance for BIs. This suggests how to gain with open innovation. As such, this integrated framework based on OIP and CE can have substantial impacts on the sustainable performance of BIs in Italy. Consequently, our propositions are:

- Proposition 1. The CE business model positively influences the relationship between IPO and sustainable performance at the BIs level in Italy.
- Proposition 2. CE business models have a positive effect on the sustainable performance of BIs in Italy.
- Proposition 3. The sources of knowledge for open innovation can positively influence sustainable performance mediated by CE business models at the level of BIs in Italy.

Once the integrated framework was developed, the next step was to submit it to specialists for external validation as referenced. The questionnaire was sent by email to the respondents. 17 instruments were sent and 10 answered questionnaires returned. In addition to the integrated structure, respondents were presented with an OIP list, extracted from the literature, to integrate the presented proposal. In other words, experts were asked whether the IPOs presented could support the integrated circular model. Respondents recommended the inclusion of IPOs with the name “circular open innovation practices (COIP)” (Figure 2) in the integrated proposa.

CIRCULAR OPEN INNOVATION PRACTICES (COIP)



Figure 2: COIP for CE (based on Santoro, Ferraris, and Winteler, 2018)

Table 1: Legend – COIP for CE (based on: Santoro, Ferraris, and Winteler, 2018)

Abbreviation	COIP - Circular open innovation practices
LTP	Licensing in/technology purchase - Van de Vrande et al. (2009), Mina et al. (2014)
PR&DA	Partnering/R&D alliances/co-patent - Lin et al. (2012)
CE	Customer engagement Van de Vrande et al. (2009), Chesbrough and Brunswicker (2014)
EI	Equity investment/M&A/JV Ahn et al. (2015)
OR&D	Outsourcing R&D Spithoven et al. (2013)
VR	Vertical technology collaboration Parida et al. (2012)
N	Networking Huang and Rice (2009)
U	University collaboration and grants Wang et al. (2012)
TS	Technology scouting Parida et al. (2012)
HT	Horizontal technology collaboration Parida et al. (2012)
NPF	National public funding Mazzola et al. (2012)

ECTOSM	E-collaboration tools/social media Scuotto et al. (2017)
OS	Patent search Van der Meer (2007)
GC	Government collaboration Mazzola et al. (2012)
ISC	Idea and start-up competition Chesbrough and Brunswicker (2014)
CE	Crowdsourcing (unknown problem solvers) Chesbrough and Brunswicker (2014)

### 3. Integrated Framework: COIP and CE

After the experts' validation and recommendations, the integrated framework is presented below, including open innovation practices (COIP-CE) (Table 2)

Table 2. Integrated framework (COIP-CE) for the circular economy

COIP - CE	Implications for sustainability	Sustainable performance
Licensing in/technology purchase (Van de Vrande et al., 2009, Mina et al., 2014)	<p>ReGENERATE - Licensing in / technology purchase that promotes a shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Licensing in / technology purchase that promotes asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Licensing in / technology purchase that promotes the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Licensing in / technology purchase that promotes the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Licensing in / technology purchase to virtualize the economy</p> <p>EXCHANGE: Licensing in / technology purchase involves replacing old technologies / materials / components with others more technically advanced.</p>	Social Economic Environmental
Partnering/R&D alliances/co-patent (Lin et al., 2012)	<p>ReGENERATE - Partnering or R&amp;D alliances that promote a shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Partnering or R&amp;D alliances that promotes asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Partnering or R&amp;D alliances that promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Partnering or R&amp;D alliances that promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Partnering or R&amp;D alliances to virtualize the economy</p> <p>EXCHANGE: Partnering or R&amp;D alliances to replace old technologies with more advanced technologies, materials or components.</p>	Social Economic Environmental
Customer engagement (Van de Vrande et al., 2009, Chesbrough and Brunswicker, 2014)	<p>ReGENERATE - Customer engagement to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Customer engagement to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Customer engagement to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Customer engagement to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Customer engagement to virtualize the economy</p> <p>• EXCHANGE: Customer engagement to replace old technologies with more advanced technologies, materials or components.</p>	Social Economic Environmental
Equity investment/M&A/J V (Ahn et al., 2015)	<p>ReGENERATE - Equity investment to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Equity investment to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p>	Social Economic Environmental

	<p>OTIMIZE: Equity investment to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Equity investment to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Equity investment to virtualize the economy</p> <p>EXCHANGE: Equity investment to replace old technologies with more advanced technologies, materials or components.</p>	
Outsourcing R&D (Spithoven et al., 2013)	<p>ReGENERATE - Outsourcing R&amp;D to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Outsourcing R&amp;D to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Outsourcing R&amp;D to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Outsourcing R&amp;D to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Outsourcing R&amp;D to virtualize the economy</p> <p>EXCHANGE: Outsourcing R&amp;D to replace old technologies with more advanced technologies, materials or components.</p>	Social Economic Environmental
Vertical technology collaboration (Parida et al., 2012)	<p>ReGENERATE - Outsourcing R&amp;D to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Outsourcing R&amp;D to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Outsourcing R&amp;D to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Outsourcing R&amp;D to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Outsourcing R&amp;D to virtualize the economy</p> <p>EXCHANGE: Outsourcing R&amp;D to replace old technologies with more advanced technologies, materials or components.</p>	Social Economic Environmental
Networking (Huang and Rice, 2009)	<p>ReGENERATE - Networking to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Networking to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Networking to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Networking to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: Networking to virtualize the economy</p>	Social Economic Environmental
University collaboration and grants (Wang et al., 2012)	<p>ReGENERATE - University collaboration to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: University collaboration to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: University collaboration to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: University collaboration to promote the remanufacturing, recycling products and components in order to return to the economy</p> <p>VIRTUALIZE: University collaboration to virtualize the economy</p>	Social Economic Environmental
Technology scouting (Parida et al., 2012)	<p>ReGENERATE - Technology scouting to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere</p> <p>SHARE: Technology scouting to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste.</p> <p>OTIMIZE: Technology scouting to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies.</p> <p>LOOP: Technology scouting to promote the remanufacturing, recycling</p>	Social Economic Environmental

	products and components in order to return to the economy VIRTUALIZE: Technology scouting to virtualize the economy	
Horizontal technology collaboration (Parida et al., 2012)	ReGENERATE - Horizontal technology collaboration to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: Horizontal technology collaboration to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: Horizontal technology collaboration to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: Horizontal technology collaboration to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: Horizontal technology collaboration to virtualize the economy	Social Economic Environmental
National public funding (Mazzola et al., 2012)	ReGENERATE - National public funding to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: National public funding to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: National public funding to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: National public funding to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: National public funding to virtualize the economy	Social Economic Environmental
E-collaboration tools/social media (Scotto et al., 2017)	ReGENERATE - E-collaboration tools/social media to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: E-collaboration tools/social media to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: E-collaboration tools/social media to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: E-collaboration tools/social media to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: Patent search to virtualize the economy EXCHANGE: E-collaboration tools/social media to replace old technologies with more advanced technologies, materials or components.	Social Economic Environmental
Patent search (Van der Meer, 2007)	ReGENERATE - Patent search to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: Patent search to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: Patent search to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: Patent search to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: Patent search to virtualize the economy EXCHANGE: Patent search to replace old technologies with more advanced technologies, materials or components.	Social Economic Environmental
Government collaboration (Mazzola et al., 2012)	ReGENERATE - Government collaboration to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: Government collaboration to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: Government collaboration to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: Government collaboration to promote the remanufacturing,	Social Economic Environmental



	recycling products and components in order to return to the economy VIRTUALIZE: Government collaboration to virtualize the economy EXCHANGE: Idea and start-up competition to replace old technologies with more advanced technologies, materials or components.	
Idea and start-up competition (Chesbrough and Brunswicker, 2014)	ReGENERATE - Idea and start-up competition to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: Idea and start-up competition to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: Idea and start-up competition to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: Idea and start-up competition to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: Crowdsourcing to virtualize the economy EXCHANGE: Idea and start-up competition to replace old technologies with more advanced technologies, materials or components.	Social Economic Environmental
Crowdsourcing (unknown problem solvers) (Chesbrough and Brunswicker, 2014)	ReGENERATE - Crowdsourcing to promote the shift to renewable energy and materials; recovery, retention and restoration of ecosystems; and return of recovered biological resources to the biosphere SHARE: Crowdsourcing to promote asset sharing; reuse; prolonging the service life through maintenance [...], with a view to reducing waste. OTIMIZE: Crowdsourcing to promote the optimization of resources with a view to increasing the performance / efficiency of products. Elimination of waste with the use of technologies. LOOP: Crowdsourcing to promote the remanufacturing, recycling products and components in order to return to the economy VIRTUALIZE: Crowdsourcing to virtualize the economy EXCHANGE: Crowdsourcing to replace old technologies with more advanced technologies, materials or components.	Social Economic Environmental

At first, the efforts of systemic planning for OIP and CE would then involve relations with individuals, since they have different ways of perceiving information and solving problems. It is hoped that prior knowledge of these practices will make it possible to trace an approximate form of what is called desirable in terms of strategies, through initiatives that favor the development of circular economy models in the field of Italian BIs. The challenge is to define strategies for improving the management of open innovation practices that support circular business models. In our opinion, this is only possible through a joint effort that involves individuals, teams, entrepreneurs, managers, policy makers, government officials, professionals from non-governmental organizations, among others involved with the cause of sustainability. In a given activity, practices must be measured for different circular model strategies. Evidently, this integrated proposal includes several elements and parts that are interrelated and observable under different aspects, which significantly influence the attitudes and behaviors of individuals, which requires a dynamic, linked, interactive and collaborative model among stakeholders.

To understand CE is, therefore, to understand how the various virtual networks, including services and organizations and their respective technologies intertwine in time. The promotion of the capacity of institutions to formulate and implement industrial policies and decide among the various options which one is most appropriate should be guided by the confluence of strategies that allow a correct assessment of the alternatives that are presented. This presupposes balancing fundamental components: society, the economy and the environment. The confluence of these perspectives is that it favors entrepreneurs to achieve sustainability through the CE.

This new scenario favors stimulating the improvement of increasingly sophisticated and refined open innovation practices to support the construction of models for the circular economy. And in this spectrum, this proposal, cadenced, integrated and dynamic, can be conceived from virtual networks of knowledge from different sources.

#### 4. Implications, research agenda and conclusion

##### 4.1. Implications

##### 4.1.1. Academic implications

This structure assumes that open innovation must be oriented towards the protection of natural resources and the reduction of environmental degradation, aiming at sustainability. In this spectrum, open innovation practices must support the circular model based on ReSOLVE and achieve superior sustainable performance. The model assumes collaboration with universities, research centers, suppliers, partners, customers, networks, digital collaboration tools, governments, non-governmental organizations, among others, in promoting open innovation in the BI spectrum,

which can represent gains in advantages competitive. These sources of knowledge can be fundamental for innovation activities to support circular business models and sustainability. This integrated framework opens a gap and suggests academic implications as follows:

- Provide advances in the development of research in the field:
- New practices of open innovation that support circular business models, with an impact on sustainable performance
- New sources of knowledge to support circular models and promote sustainable performance impacts
- Structures of intelligent models for knowledge treatment in order to prioritize knowledge to support circular models
- Digital technologies as a facilitator of open innovation and support for circular models and sustainability
- Management practices as facilitators of open innovation practices to support circular business models.
- Incubators and business as a facilitator of sustainable entrepreneurship and innovation to support circular business models and sustainability.

#### ***4.1.2. Implications for management practice***

The demands for information and knowledge are enormous. Deciding on best open innovation practices is an ongoing process of assessing future needs. And in this spectrum, human resources have an essential role. This process presupposes people with adequate skills to perform the right tasks at the right time and place. In this spectrum, the perspective of management efficiency must be based on methods and techniques that favor efficient planning that supports decision making. This integrated framework enables entrepreneurs to assess the sustainable performance of BIs from OIP oriented towards regeneration, sharing, optimization, and return to the economy, and exchange, with prospects for creating social, economic and environmental value. In our opinion, the knowledge of external sources, such as customers, suppliers, non-governmental organizations, and other alliances, allows companies to gain competitive advantages, creating for BIs, customers, suppliers, other stakeholders. Evidently, this proposal can be expanded to include other variables such as: the absorptive capacity of knowledge. This proposal starts from a gap in the literature and can be improved in other studies. Although this proposal has undergone external validation, it is recommended that the sample of specialists can be increased for greater consistency of this framework. It is also recommended that this structure be applied to real cases. This integrated structure has implications and an agenda described below.

#### ***4.1.3. Implications for policy makers***

We understand that the success of circular models requires a joint effort by both the public and private sectors. Government and industrial policies must guide the managers' agenda to support circular models and boost sustainable entrepreneurship towards superior sustainability performance. The roles of governments in promoting knowledge networks for circular models in the context of incubators and entrepreneurship are elementary, considering the importance of environmental protection alongside an economic objective, towards competitiveness. For policy makers, we recommend investments as facilitating in promoting economic development and competitiveness, respecting the scarcity of resources and environmental protection. In order to support entrepreneurs, solid legislation, regulations and incentives as policies are recommended to encourage entrepreneurship and open innovation for economic development and job creation, with sustainability. In addition, policymakers should enhance incentives, such as funding funds, universities, science parks, incubators and businesses and startups, contributing substantially to the elimination of barriers and the implementation of circular business models. It is in this panorama that the contribution of this integrated framework is expected, as a strategic element in programs of this nature.

#### ***4.2 A Research Agenda***

In addition to a methodological discussion, we hope to contribute to new CE studies, also by raising a collection of bibliographic sources that can still be explored. It is believed to have systematized some strategic elements for the business models for the CE. And this fact reinforces the importance of understanding the EC as a demand that only makes sense when meeting the needs of society in this context. Through this proposal, a more pragmatic and efficient orientation is also sought, subsidizing the guidelines for the development of new business models for the CE in the long term, overcoming inefficient practices for achieving sustainability. Finally, we have a research agenda

- How can each open innovation practice help strengthen circular models and sustainability?
- What are the main challenges in adopting open innovation practices for the implementation of circular models?
- What are the impacts of open innovation practices on sustainable performance under ReSOLVE?
- How can open innovation help in the process of recycling materials?
- How do open innovation practices impact sustainable performance in circular models?

- How can entrepreneurs encourage open innovation practices for circular models?
- How can customers' knowledge contribute to support circular models and increase the sustainable performance of Bis?
- How can suppliers' knowledge contribute to support circular models and increase the sustainable performance of BIs?
- How can the knowledge of universities and research centers contribute to support circular models and increase the sustainable performance of BIs?
- How to reduce waste through open innovation practices?
- How can open innovation help with cleaner production?
- How can open innovaiton practices help to reduce the waste of energy and materials during the production process?
- How can open innovation practices contribute to the exchange process or way of doing things (such as replacing old technologies with new ones) while reducing the environmental impact?
- How can open innovation practices help in the recycling or remanufacturing process and return to the economy?
- Figure 3 presents the agenda for the construction of knowledge for the EC in a network carried out through the sharing of knowledge of several actors in the knowledge network, making it possible to expand knowledge for innovation that will support the circular business model in BI in Italy.

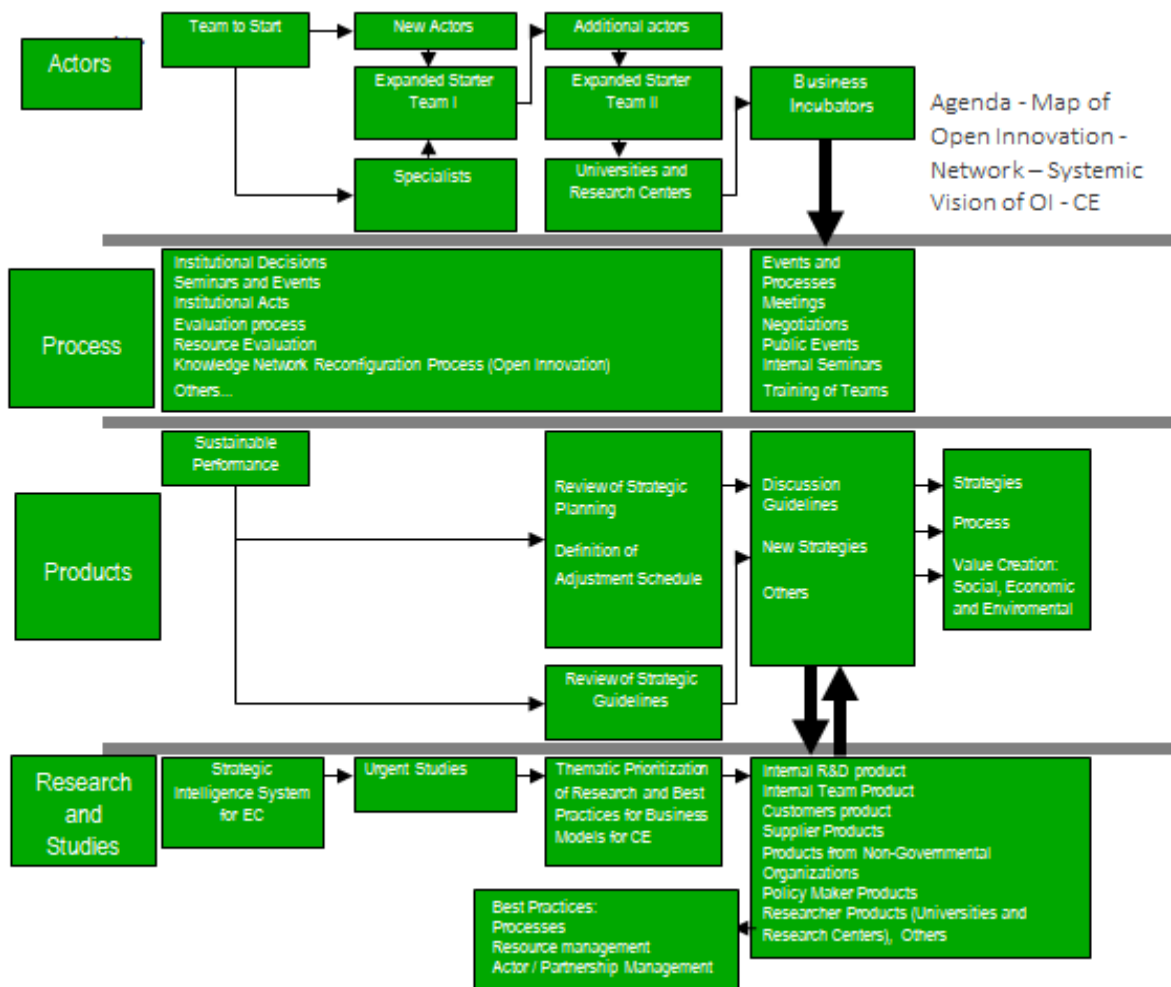


Figure 3: Agenda - Building knowledge for EC Business Models - Open Innovation/Knowledge Networks for CE – BI

**4.3. Conclusion**

This article aims to contribute to a policy of innovation in the field of (CE). To do so, it presents An integrated framework for the CE based on (IOP) practices towards sustainability. The research was addressed to Italian business incubators (BIs). The characteristics of the circular models differ very much, becoming the object of analysis equally differentiated. This way, the building-up and management of a circular business model represent complex and risky procedures that can affect the flow of decision making, frustrating expectations of stability. It is hoped that this

conceptual framework can guide the actions of decision makers, governments and entrepreneurs, promoting gains with competitive advantages towards sustainable entrepreneurship. The building-up and the management of a circular business model require highly complex analytical approaches, which include subjective elements. Thus they demand the technical mastery of various technological, legal, financial and political aspects and procedures. Knowledge Management may represent a strategic tool, increasing the institutional capacity of business incubators and the Entrepreneurs in their assignments of formulation, evaluation and execution of such models. We are looking forward to a more practical and efficient orientation supporting its long-term goals and assuring national competitiveness concerning the category of priorities. This framework does not intend to be complete, but it is our intent to make it a generator of strategic elements for the development of partnership

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