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Designing and testing a new **Sustainable** Business Model tool for Multi-actor, Multi-level, Circular, and Collaborative contexts

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Highlights

- The paper presents a process to develop circular business models for sustainability
- It identifies and justifies the gaps which this circular business model addresses
- It helps visualize, connect and align the circular business models of organizations
- 15 workshops with 400 students and practitioners provided positive feedback
- One of the 9 cases is presented as an illustration of how our model can be applied

Abstract

No project for the transition to the circular economy can be carried out by a single organisation. This research addresses a gap by presenting a process and a set of tools to facilitate the development of circular business models. It contributes to building circular ecosystems by visualizing the parties involved, connecting and aligning their business models. Applying our framework can train people and help organizations achieve collective outcomes. Credence can be given to our claims as they have been tested in various contexts. 400 students and practitioners were involved in 9 business cases. An application is presented using data from a real case and a combination of role games.

Keywords

Circular business model; circular economy; circular ecosystem innovation; sustainability

1. Introduction

In order to address environmental and social challenges, practitioners, public authorities and academics are paying great attention to the circular economy (CE). Through closed loops, its main objectives are to reduce the production and consumption of virgin raw materials and energy, and to reduce the amount of waste and emissions (Geissdoerfer et al., 2017). The CE attempts to conceptualize the integration of economic activity with environmental and social wellbeing (Murray et al., 2017). Authors now consider the CE as a subset of sustainable development (Bocken et al., 2014), as a concept that operationalizes it (Kirchherr et al., 2017) or as a substitute for it (Merli et al., 2018). Recently an increasing number of articles have emphasized the importance of Business Models (BMs) due to their high leverage potential for the CE (Lieder and Rashid, 2016; Kirchherr et al., 2017; Nußholz, 2017; Merli et al., 2018; Pieroni et al., 2019). However, there is still little in terms of empirical work (Kirchherr and van Santen, 2019) or methodology which describes how organizations should adapt their BMs (Planing, 2015; Merli et al., 2018; Bocken et al., 2019) or how they could operationalize CE principles (Suárez-Eiroa et al., 2019, Geissdoerfer et al., 2020). If transitioning to a CE requires product and BM innovation, circular business ecosystem innovation is required to bring together previously unconnected actors and explore how to reach sustainable outcomes from previously unrecognized angles (Konietzko et al., 2020a; Madsen, 2020). However, there is little research on new business management perspectives (Camón and Celma, 2020), especially on tools which can assist organizations (Demil et al., 2018), in order to reach a greater sustainability in circular ecosystems (Zaoual and Lecocq, 2018; Konietzko et al., 2020a, 2020b).

Thus, this article focuses not only on the design of a CE BM which addresses existing gaps, it also deals with how, practically, it can be applied. Our research question is as follows:

“How to design and test an easy to use BM tool which incorporates CE principles and stimulates innovation as well as collaboration in multi-actor, multi-level networks or in circular ecosystems?”

Section 2 reviews the literature on sustainable and circular BMs (S/CBMs) in order to identify existing proposals and their limitations. Section 3 presents our methodology. Section 4 describes the BM³C²

framework, a new Business Model, Multi-actor, Multi-level, Circular and Collaborative. Based on previous research by Boldrini and Antheaume (2019), it aims at providing theoretical contributions on (circular) innovation ecosystems (Konietzko et al., 2020a), as well as a proposal for circular BMs, by addressing shortcomings we identified. Section 5 illustrates, through one of the real case studies we worked on, the protocol we used to test the model. Section 6 discusses the three contributions of the research on the BM³C² framework.

2. A review of literature on sustainable and circular business models

The best known BMs exclude the natural environment from their analysis, as well as the stakeholders other than customers, partners, suppliers and shareholders. They display a limited understanding of costs and benefits and do not allow for long term decision making. They focus on linear material flows and lack a systemic perspective (Biloslavo et al., 2018). Sustainable and circular BMs were conceived as a response to these limitations. We used the literature dedicated to BM innovation to sum up the characteristics of sustainable and circular BMs (Boldrini and Antheaume, 2019) (Fig. 1).

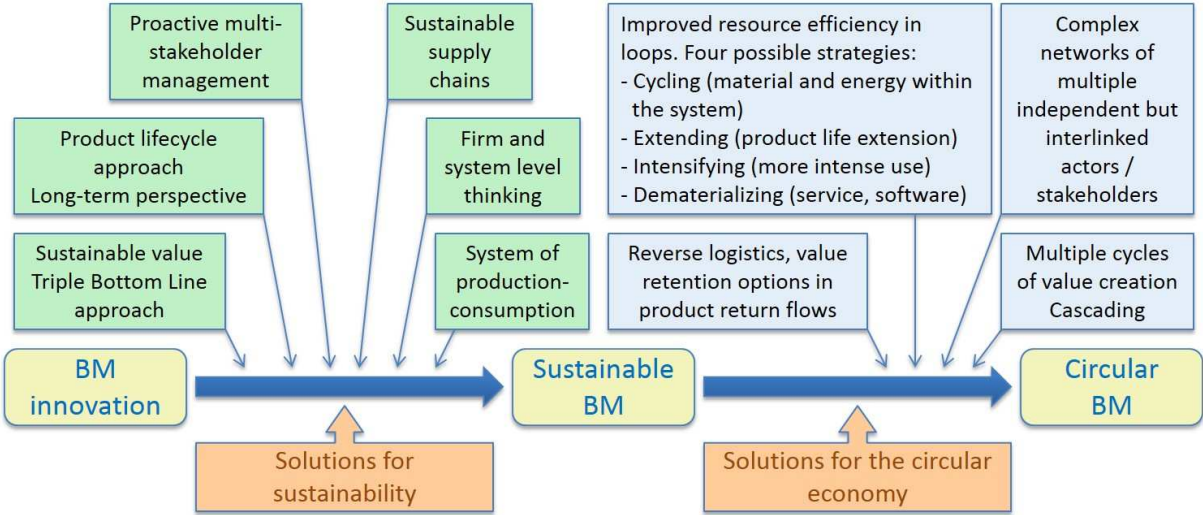


Fig. 1. The main characteristics of S/CBMs (Authors, adapted from Geissdoerfer et al., 2018, 2020; Stubbs and Cocklin, 2008; Antikainen and Valkokari, 2016; Bocken et al., 2018, 2019; Reike et al., 2018).

2.1. Sustainable business models

Sustainable business models (SBMs) aim at creating value not only for customers but also for society. Innovations in the way activities are carried out change the way an organization and its network will create, deliver and capture value (Bocken et al., 2014). As opposed to traditional BMs, SBMs create sustainable value. By this they aim to integrate and balance with each other economic, environmental and social dimensions (Stubbs and Cocklin, 2008; Boons and Lüdeke-Freund, 2013). A sustainable value proposition should have a positive impact on such aspects as resource use efficiency, longevity of products and organizations, social relevance, procurement ethics or employee task enrichment (Täuscher and Abdelkafi, 2017). The concept of Triple Bottom Line (TBL) (Elkington, 1997) is often used. With its 3Ps (Planet, People, Profit), it is associated with sustainable value. In order to minimize the social and environmental impacts of activities, SBMs have to adopt a long term perspective (Stubbs and Cocklin, 2008; Rong et al., 2018). They have to take into account the interests of a large range of stakeholders, throughout the product lifecycle, including the natural environment and society, and interact with them in a proactive manner (Bocken et al., 2014; Geissdoerfer et al., 2018). Supply chains have to be managed with suppliers and retailers, in order to guarantee a sustainable supply chain for materials (Lewandowski, 2016). SBMs must allow the focal organization *and* the ecosystem to which it belongs to become sustainable (Stubbs and Cocklin, 2008; Konietzko et al., 2020a). Also, the initiatives of organizations would be in vain if customers did not change their behaviour. SBMs can thus act as mediators which connect production and consumption (Boons and Lüdeke-Freund, 2013) and encourage consumers to take their share of responsibility (Lewandowski, 2016).

2.2. Circular business models

Circular business models (CBMs) are an extension of SBMs. Some authors (Antikainen and Valkokari, 2016; Geissdoerfer et al., 2018) even consider them as a sub-category of SBMs. Their specificities are

linked to the concept of loops which entail the idea of circularity. Value creation is based on reverse logistics, which enables retention of value and a “renewed” value proposition (Reike et al., 2018). Loops must take production, distribution as well as consumption activities into account (Lieder and Rashid, 2016). Without customer demand, these supply chains would not be viable (Kirchherr et al., 2017). Return loops enable to improve resource use efficiency in two ways. Virgin raw materials can be substituted by secondary raw materials (Nußholz, 2017). Other than closing material loops, firms may adopt strategies such as: slow down material flow rates in order to lengthen the useful life of products, narrow flows in order to reduce energy and material consumption, intensify the use of a given product (pooling, sharing...), or dematerialize it (services, digitalization) (Geissdoerfer et al., 2018). This entails a search for cascading, meaning multiple cycles of value creation thanks to consecutive use of resources. CBMs are interconnected and require communication and coordination between multiple independent but interdependent stakeholders nested within complex networks (Antikainen and Valkokari, 2016).

2.3. The gaps of existing sustainable and circular business models

Nearly all the existing SBMs and CBMs (Antikainen and Valkokari, 2016; Lewandowski, 2016; Joyce and Paquin, 2016; Bocken et al., 2019; Daou et al., 2020) are extensions of the Canvas (Osterwalder and Pigneur, 2010). These models can mostly be summed up as an enrichment of existing Canvas blocks, by adding references to return loops and return mechanisms in the “distribution channels” block, or by adding blocks which integrate macro-environmental elements or which evaluate the sustainability / circularity of the BM. We identified four major gaps which these models contain.

First, even if the CE transcends firm boundaries, today all CBMs only represent just one organization. Surprisingly, so far, there are no models which explicitly represent the relations between the CBMs of organizations involved in open innovation, networks, or circular ecosystems (Konietzko et al., 2020a). The lack of possibilities to show the interconnections needed between BMs will prevent actors from seeing where they have to coordinate in order to develop common value propositions. Cooperation

and communication will be more difficult (Antikainen and Valkokari, 2016). Also, this means that innovations, introduced in the BMs of each single organization, will lack an overall coherence (Pieroni et al., 2019). Indeed the BMs of each organization, taken individually, will not enable to represent how they relate and adjust to each other and to their respective components (combinations of resources, connections with actors of the value network) (Boons and Lüdeke-Freund, 2013).

Second, no current CBM makes it possible to visualize the direct and reverse logistic flows between organizations, as no one represents the relationships between these organizations. As closed loops are one of the essential principles of CE, completing the “distribution channels” block is not enough to model flows in supply chains (Lieder and Rashid, 2016).

Third, if some SBMs or CBMs display a sustainable value proposition (Joyce and Paquin, 2016; Bocken et al., 2019), not all adopt a TBL approach. The economic dimension is not always supplemented by an environmental dimension (Boons and Lüdeke-Freund, 2013) and even less by a social one (Murray et al., 2017). Sustainability checks are rarely made in the other BM blocks (Bocken et al., 2019). De facto, most existing SBMs and CBMs are incapable of representing complex social and environmental systems which make up the backdrop of all businesses (Upward and Jones, 2016).

Fourth, the visual representation of most BMs is a good outcome of the thinking process, but it hides the often long and difficult building process, as well as the evolving and dynamic nature of its design (Bocken et al., 2014; Täuscher and Abdelkafi, 2017; Rong et al., 2018; Bocken et al., 2019). As a result, today there are almost no practical handbooks to guide businesses through the transformation of a linear BM to a circular BM (Konietzko et al., 2020a) or to operationalize CE principles (Suárez-Eiroa et al., 2019).

The BM³C² framework aims at finding solutions to these shortcomings and to contribute to a better knowledge of the dynamics and processes which enable organizations to progressively as well as collectively connect, align, adjust and evaluate their CBMs (Lieder and Rashid, 2016; Ghisellini et al., 2016; Winans et al., 2017; Konietzko et al., 2020b; Madsen, 2020). Before presenting the model, let us turn to the methodology section.

3. Methodology

In 2013, we were invited to join a cross-industry R&D project in order to help a group of stakeholders develop and test an innovation for plastic films designed to protect crops for horticultural farming. Until then, plastic films were purchased by farmers, put up for single use and disposed of. The used films were then sold and transformed into recycled plastic pellets for use in lower quality products such as bin bags. The focal firm of the project was a manufacturer of agricultural films. It had developed a process to recycle used soiled films, collected in surrounding farms, and to manufacture a new “isocycled”¹ product.

However, moving forward implied several questions: How to organize the collection and deal with the level of soil in these plastics? How to measure economic and environmental benefits? What new relationships should be developed between the farmers and the manufacturer? The initial framing of the focal firm, when it contacted the authors, was not to ask for help in testing a BM, but the questions asked represented all the elements of a BM. One ambition of this project was to help its participants become more sustainable by implementing CE principles. As we became “embedded” in the project, we noticed the difficulties associated with testing a BM with sustainability and CE principles. Existing BM tools were not satisfactory. As mentioned in the review of literature, these BMs represented the level of one organization and did not enable explicit connections with other ones. Each stakeholder came with its own BM and it was difficult to connect it with the others. We saw the need for a tool at a higher level, which would lead stakeholders to adopt a wider and inter-organizational perspective. The literature we reviewed, from 2014 to 2019, confirmed this gap and led us to look for theoretical foundations in the CE and BM innovation literature in order to design a new CBM tool addressing this gap (Boldrini and Antheaume, 2019). We tested it from 2017 to 2020 with several cross-industry innovation projects.

¹ “isocycle”: neologism meaning same function, same as value or same quality after second use or recycling.

We also became convinced that no CBM would ever be built, even with the best possible model, if we did not develop training and implementation protocols based on case studies and experiential learning (Bocken et al., 2019). This would benefit students and organizations seeking to develop CBMs, drawing on the lessons of the project in which we took part. Our aim was to propose a pedagogical tool for teaching sustainability and CE, through “hands on” application of CBMs (Figueiró and Raullet, 2015; Leal Filho et al., 2018; Kirchherr and Piscicelli, 2019). Our process is presented in Fig. 2.

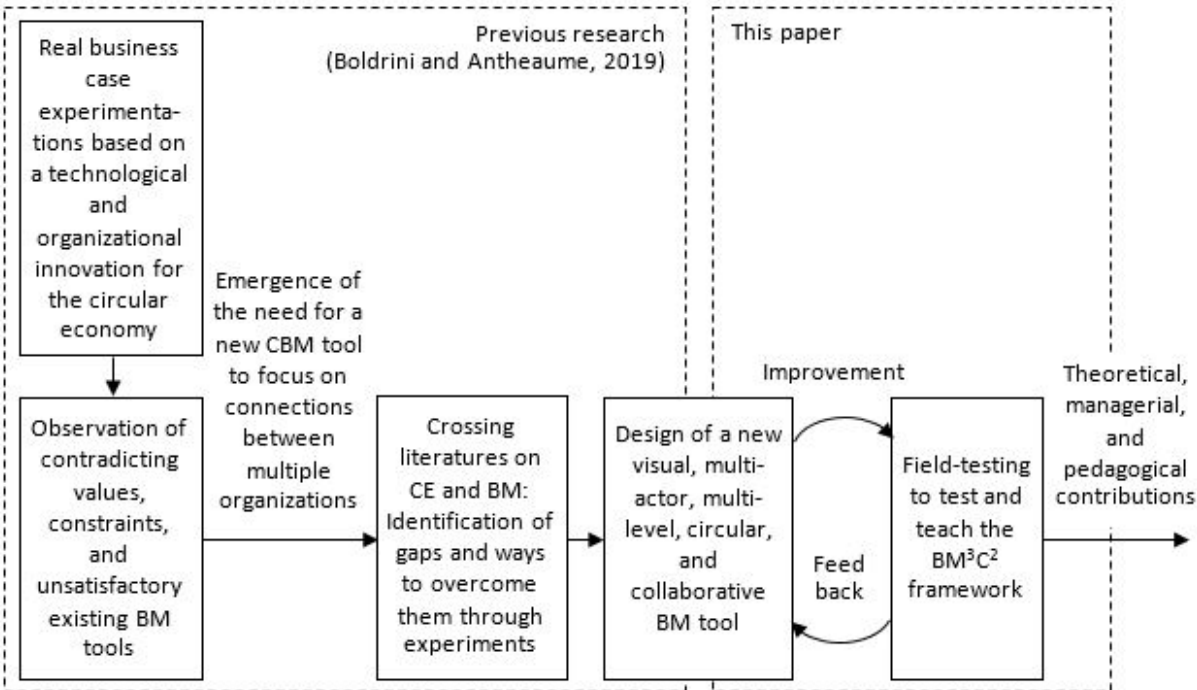


Fig. 2. Research process.

Since the first request, we and our partners have been involved with nine organizations or partnerships (see Table 1 in Supplementary Materials for details). We experimented successive versions of the BM³C² framework with students and professionals from different backgrounds. Some cases were experimented more than once. We used creativity-based sessions, role plays, or student-consulting teams for training, testing and observation purposes. In some cases, the partner organizations were involved in the experiments with students and we were able to give them multiple feedbacks.

To test and improve our BM tool and to collect a plurality of feedbacks, we organized 15 workshops over 3 years, lasting from 3 hours to one day, five 6-month graduation projects, and five vocational workshops involving more than 400 people (students and business professionals) from multiple organizations (see Table 1 in Supplementary Materials for details on the projects, their aims, their outcomes, the pedagogical experiments, and the participants' background). The common aspect of all the workshops is that the participants are handed over a brief which presents the case and the organizations involved. If they do not have the prerequisites, they receive a short training on the CE, and on S/CBMs. Our CBM framework is then presented. The participants are requested to apply it to the case, adopting the role of one of the parties involved. We ask the participants to design their proposals in view of connecting together the BMs of the organizations involved. Each test has its specificities. Sometimes we hand out role cards, so the participants can play the role of key stakeholders and take into account their interests and psychological profiles. Sometimes the head of the focal organization is here to interact with the students. Sometimes students-consulting teams, in graduation projects, are requested to write a report to the client, with recommendations. Sometimes the participants are not students but professionals. During our experiments we focus on observing how the participants are able to use our framework. The graduation projects we supervised were an opportunity for the students to experiment the role of consultants with a real assignment defined by a real client. We used student deliverables and the results of 197 usable assessment sheets (see Table 4 in Supplementary Materials) filled after the workshops to iteratively improve the framework. Combining a single-case study research, with experiments as embedded units of analysis (Yin, 2014) allowed us to access rich data. The "construct validity" of the research has resulted from the variety of people involved and material produced, the short reports written on the cases and approved by the actors involved, and the convergence of evidence from these multiple sources (Yin, 2014). Iterations between literature, experiments and assessments give us confidence that the BM³C² framework is useful for practitioners and teachable to students. Indeed, pattern matching between theory and field-tests, as well as the description of the logic and of the building explanation of BM³C²

(section 5.3) guarantee “internal validity” (Yin, 2014). The experiments had the following outcomes: we trained more than 400 students, professional, or scholars and solicited their feedback (which was mainly positive, see section 5.3.). At the end of each workshop, we ended up with many application proposals from the students which were reviewed and commented by the partner organizations. These proposals had practical implications for them. Some of the consultants involved with us, in the experiments, have turned this CBM framework into business proposals for their customers. Due to the number of experiments replicated and the diversity of real cases, we consider that our research has an “external validity” (Yin, 2014) for any CE transition project. The fact that additional resources² (tutorials, library of cases, trainer’s guide...) complement the BM³C² framework (section 5.3) guarantees the “reliability” of our research and the possibility for other people to replicate it (Yin, 2014).

4. Presentation of the BM³C² framework

Based on the gaps identified in the literature, we propose a new CBM framework. We first explain our choice of the RCOV BM (Demil and Lecocq, 2010) and explain how we turned it into the BM³C² framework (4.1.). We then present its components (4.2.) and the process by which the BM³C² framework is built (4.3.). Finally, we compare the BM³C² framework with other visual S/CBMs (4.4.).

4.1. A path for turning the RCOV model into a CBM

In their RCOV model (Fig. 3), Demil and Lecocq (2010) assume that three core components can be used to describe a model: resources and competences (R&C), organizational structure (O) and value propositions (V). The RCOV model presents three characteristics which respond to the shortcomings we identified. The first one is internal and external consistency. The components are not independent from one another. Designers have to check that they are well connected and fit with

² www.bm3c2.fr

one another. The second one is parsimony. With only three main blocks (R&C, O, V), it is better suited, in the context of a CE, for multilevel and complex connections. Indeed with a 9-block model, and a TBL approach, connecting just two organizations would require 2 organizations x 9 blocks x 3 dimensions equals 54 components. A comprehensive yet simpler and parsimonious model is needed to make complex interconnections manageable. The third characteristic is dynamism, defined by Demil and Lecocq (2010) as the capacity of a BM to be adjusted and evolve. It is much needed in experimentation phases and during the transition towards a CE. The first version of a BM is never the final one.

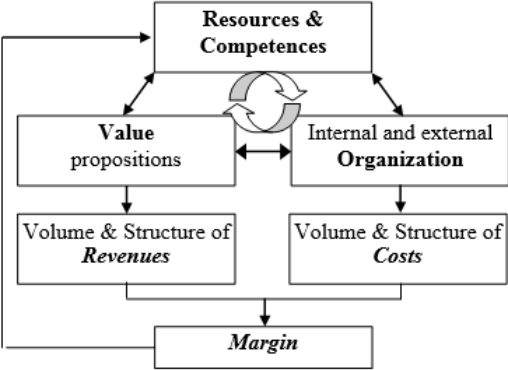


Fig. 3. The RCOV model (Demil and Lecocq, 2010, p. 234).

In order to replicate CBM characteristics, we rearranged and enriched the RCOV blocks. Indeed, the time sequence of a BM design is subject to debate (Antikainen et al., 2017; Bocken et al., 2018, 2019). The difficulty to change “business as usual” has been identified as a reason why CBMs are not yet widespread. As a result of debates in the literature and of feedback provided during our experiments, we decided to start with the value proposition. We consider: (i) as Lewandowski (2016) that the value proposition is the key element of a CBM, (ii) as Bocken et al. (2019) that it is the starting point to create an offer that suits customer needs, and (iii) as Täuscher and Abdelkafi (2017) that it is a good way to achieve a faster reduction of environmental impacts. We thus extended the

RCOV model accordingly and integrated social and environmental dimensions, alongside with the economic one (Fig. 4).



Fig. 4. The extended RCOV model (Authors, adapted from Demil and Lecocq, 2010).

This extended RCOV model represents just one organization. In order for it to become circular, we need to connect it with at least one other organization. For the purpose of clarity, in this paper, our study is limited to the connection of two organizations with five types of inputs and outputs (resources, energy, money, information, and values) (Brehmer et al., 2018). Once two-extended RCOV models are placed alongside one another, it is easy to represent the values shared and the flows of matter, energy, money, and information. Indeed they are more understandable when visually represented. Fig. 5 proposes a simplified representation of our CBM tool. Circularity can be achieved only by connecting the BMs of the stakeholders involved. It offers the potential to alter material flows and other exchanges (Merli et al., 2018; Nußholz, 2017). It is a response to the major challenge of tackling the cognitive problem of thinking outside the dominant linear economy logic by connecting individual BMs with one another (Bocken et al., 2019; Täuscher and Abdelkafi, 2017). It

also puts an emphasis on common values and objectives, or cultural fit as a starting point which marks the will of two organizations to cooperate with one another and share resources (Konietzko et al., 2020a). Information exchange becomes a key component of the model as it is identified as critical in the success of CE initiatives (Winans et al., 2017). We give the name of BM³C² (Business Model, Multi-actor, Multi-level, Circular, and Collaborative) to this extended RCOV model. It is comprehensive, yet parsimonious. It offers the opportunity to design CBMs in a dynamic and collaborative manner. Fig. 5 is a blank framework which consists of three parts: two “organization” frames linked by a “connexion” one. It enables the explicit visualization of CE principles in a CBM (physical flows, connections between organizations...) (Nußholz, 2017; Merli et al., 2018). To fill in the framework, the main cognitive challenge is to move beyond the dominant-organization focused logic, and reflect the connections and alignment of each organization with the other ones, while focusing on cooperation (Täuscher and Abdelkafi, 2017).

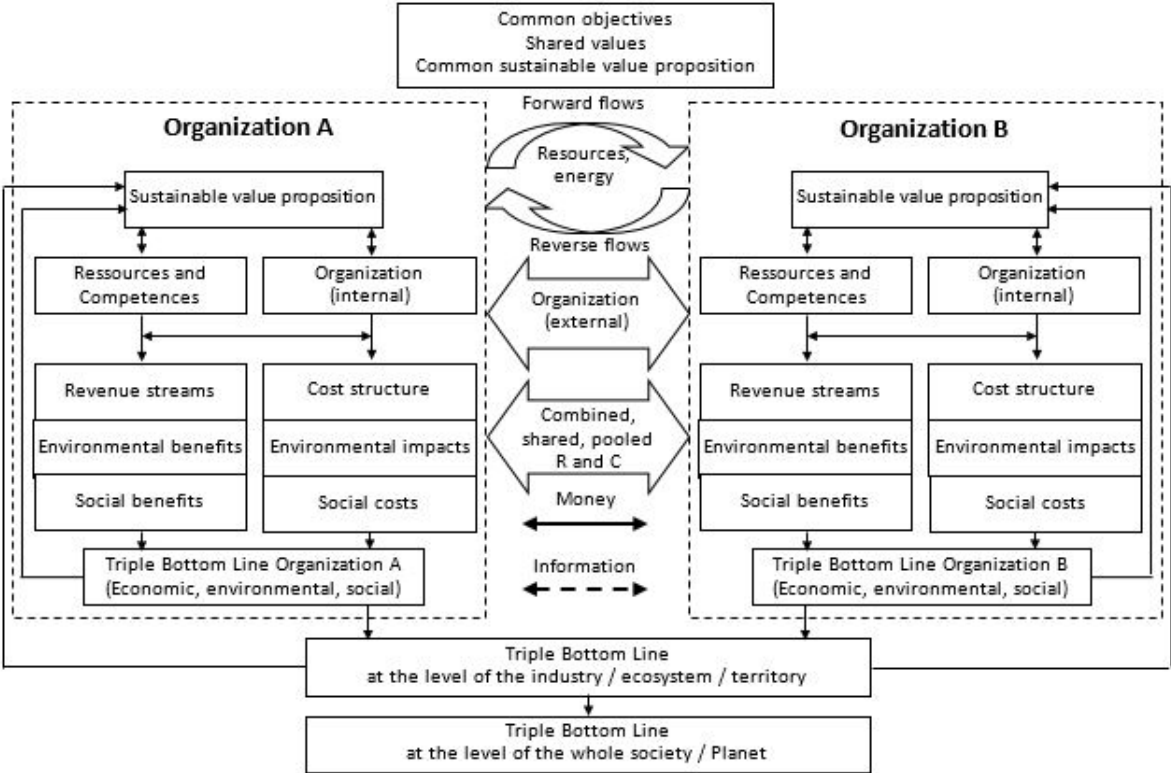


Fig. 5. The BM³C² framework (Authors).

We now turn to the components of the model (4.2) and the process for connecting BMs with one another (4.3) in order to obtain a full BM³C².

4.2. Components and characteristics of the BM³C² framework

Let us describe the components of the BM³C² framework (Fig. 5). Please refer to Boldrini and Antheaume (2019) for more details.

Sustainable value proposition

Even if value-focused innovative practices should embody a CE philosophy, reformulating the value proposition of products and services still remains marginal in academia (Merli et al., 2018). Environmental and social values identified at an early stage will make it easier to tackle related issues right from the beginning. The value proposition must include social and environmental benefits that a company and its partners can offer to customers and stakeholders (Bocken et al., 2014, 2018; Boons and Lüdeke-Freund, 2013). The condition is that before satisfying customers, the value proposition must contribute to preserving environmental and societal capital. It can be embedded in sustainable product-service systems (SPSSs) (Manzini and Vezzoli, 2003). It has to take into account rational and non-rational motives of consumer behavior (Planing, 2015). In order to achieve the desired goals, it is essential to include ‘sustainability checks’ (Bocken et al., 2018) before pursuing with value creation and delivery.

Resources and competences

They are usually broken down into six categories: human, technical, physical, financial, organizational and reputational. Following the “Extended resource-based theory” (Warnier et al., 2013), the value of a resource or a competence is not an intrinsic characteristic. It depends on the knowledge and beliefs of managers. Accordingly, a junk resource, such as waste, could create value and be a source of competitive advantage if it leads to the emergence of new BMs (Warnier et al., 2013). The CE, and the imperative to connect organizations through loops, are powerful levers to turn junk resources into valuable ones. A strong feature of our model is precisely to identify “uncaptured value” and to

turn it into value opportunities (Yang et al., 2017a, 2017b) as well as to extend value as long as possible (Merli et al., 2018).

Organization (internal)

In internal organization, mainly three activities are to be considered for the CE: design, supply chain management, and customer relationships. The early design stage is important because the choices made during this phase will have consequences during the lifecycle of the product (de Mattos and de Albuquerque, 2018). The activities of the forward supply chain are usually well managed but CE reverse supply chains also have to be designed (return logistics, sorting of product return, recovery, recycling...) (Ghisellini et al. 2016). Sufficiency also has to be encouraged, both in production and consumption (Bocken et al., 2014). To reduce resource consumption and environmental impacts, firms tend to replace the sale of products by services.

Costs, revenues, and triple bottom line

The volume and structure of costs and revenues have to take the four dimensions of corporate sustainability into account (economic, environmental, social, lifecycle orientation) (Geissdoerfer et al., 2018; Ghisellini et al., 2016). The BM³C² has no dedicated layers for environmental and social issues (Joyce and Paquin, 2016). In this model, environmental impacts, social benefits and costs are identified in dedicated blocks and/or quantified through activities such as eco-design, life cycle assessment or social responsibility assessment. ‘Sustainability checks’ (Bocken et al., 2018) ensure that the desired sustainability goals are not forgotten. The “Triple Bottom Line” component synthesizes the overall contribution of the organization over three dimensions (economic, environmental, and social). The representation of the overall value created allows partners to align their expectations and capture a part of it (Zott and Amit, 2010).

4.3. Process for connecting and aligning BMs

Now that our framework has SBM characteristics, two or more BMs have to be connected and aligned to obtain a real CBM.

Common objectives, shared vision and values, common sustainable value proposition

Before developing a BM³C², it is important to start defining common business objectives and identifying shared values in order to embed circularity through a common sustainable value proposition that stakeholders will experiment (Stubbs and Cocklin, 2008; Bocken et al., 2018). As circular ecosystem innovation is generally initiated with the early commitment of new and previously unconnected actors, defining a clear problem or challenge is crucial at the beginning of a project (Konietzko et al., 2020a, 2020b). A clear and genuine common vision will help: (i) provide direction for the joint strategy through a shared understanding of the higher-order problem, (ii) develop a common language, (iii) reduce opportunistic behavior and misalignment between individual and shared interests, and (iv) design a common value proposition with system-level goals for sustainability (Konietzko et al., 2020a; Madsen, 2020).

Combined, shared, and pooled resources and competences

After each organization has defined its own resources and competences, a discussion must take place to identify which ones will be shared, combined, or pooled. The clearer and the better common objectives have been defined, the easier this discussion is. Ecosystems that bring together heterogeneous actors may offer opportunities for creating value by reframing what resources mean (Konietzko et al., 2020a), or by valuing “ordinary” and “junk resources” that were previously unconsidered (Warnier et al., 2013).

External Organization

Networks, consisting of independent organizations involved in long-term relationships, need orchestration to achieve collective goals (Zaoual and Lecocq, 2018). In a BM³C², the external organization enables the coordination between stakeholders within a value network (Demil and Lecocq, 2010). As CBMs are intertwined, cooperation is essential to ensure the sustainability of the system to which each organization belongs (Stubbs and Cocklin, 2008; Bocken et al., 2018, 2019). Putting an external organization into place, in a CBM, is an exploratory trial and error process, thus a dynamic one. The aim is to identify what enables the co-creation and sharing of sustainable values by

the partners involved (Rong et al., 2018). This requires organizational routines and a clear governance structure, as well as relationships which create trust and commitment. Regular peer-to-peer interactions, conducted as informal, egalitarian, and primarily horizontal communication, are seen as fostering innovation and forming a sense of community (Madsen, 2020). There is however the need for “matchmakers” who facilitate inter-organizational cooperation for matching opportunities among organizations (Zaoual and Lecocq, 2018), or for “ecosystem coordinators” who oversee “the big picture” by mediating, coaching, motivating partners, and managing the combined work packages (Konietzko et al., 2020a).

Forward and reverse logistics flows

Supply chains are essential CE components and cooperation is needed to ensure efficient design and operations of reverse logistics in closed-loops (de Mattos and de Albuquerque, 2018; Bocken et al., 2018). The central “connection” frame of the model allows to clearly visualize both forward and reverse flows of materials or energy, without prejudging of what other strategies (slowing, narrowing...) should be implemented to improve resource efficiency in the loops (Geissdoerfer et al., 2018).

Money and information flows

The BM³C² framework offers a clear representation of the money that circulates between partners. This must guarantee, through transparency, the right balance between how value is created and how it is shared. Achievements of “early wins” as well as a fair value sharing scheme are important to ensure that partners maintain commitment and trust in the project and deliver the expected contributions (Konietzko et al., 2020a). Even if value is co-created, the partners may not have the same expectations and perceptions of what is being created. Thus, the value that is created has to be assessed at the organizational and partnership levels (Boons and Lüdeke-Freund, 2013; Pieroni et al., 2019; Stubbs and Cocklin, 2008). The BM³C² framework allows such an assessment. It includes the information flows which are necessary for coordination and for value co-creation (state and location of assets, frequency and volume of distributions and collections...). Managing data flows is an

important avenue for innovation in circular ecosystems. Knowledge sharing feeds discussions that reinforce common vision and goals, provides information on the agreements and disagreements of the parties (Konietzko et al., 2020a), and enables a new and higher level of understanding of the context. Over all, it allows collective intelligence by imagining new connections and opening up new possibilities.

Triple bottom line assessment at higher levels

S/CBMs require thinking beyond a single organization level. Individual organizations can only be sustainable if the entire system to which they belong also becomes sustainable (Stubbs and Cocklin, 2008). Thus, results must be evaluated at the level of each organization and also at a higher level (sector, territory...). To achieve BM consistency and optimal performance at the higher level, the triple bottom line translates into increased social welfare for all organizations, reduced environmental impacts and increased revenues (Joyce and Paquin, 2016; Geissdoerfer et al., 2018). The BM³C² framework distinguishes between TBL assessments at three levels: the micro level of each organization, the meso level of their network, ecosystem or sector, and the macro level (cities, regions, countries or even the entire planet) (Merli et al., 2018). This avoids partial optimization at the micro level alone (Zott and Amit, 2010). Indeed, significant CE improvements at the firm level may not necessarily translate into global progress but, on the contrary, lead to rebound effects (Ghisellini et al. 2016; Nußholz, 2017). At the macro level, the CE should aim to return within "planetary boundaries".

As a conclusion, the BM³C² framework has the ambition to contribute to a systemic view for a "flourishing planet" (Elkington and Upward, 2016) with a "BM thinking" that puts creativity at the heart of strategy (Demil et al., 2018). To make sure that the BM³C² tool is teachable and that practitioners can use it, we conducted a series of experiments based on real business cases (see Table 1 in Supplementary Materials).

4.4. A comparison of the BM³C² framework with other SBMs and CBMs

A comparison of the BM³C² framework with other visual SBMs and CBMs is provided to show its contributions with respect to the CE principles summarized in Fig. 1 (see Table 2 in Supplementary Materials).

To summarize Table 2, the main contribution of the BM³C² framework is that it allows visualizing several BMs and their connections. So far, to the best of our knowledge, no other model offers this possibility. This new property has three interests. First, forward and reverse logistics flows become easy to depict. It may help to improve the supply chain efficiency and the value retention of resources. Second, several BM³C² frameworks placed alongside one another may visualize multiple cycles and cascades that also may improve the value retention of resources or extend the lifecycle of products. Third, the representation of three levels (micro for the organizations, meso for their industry or territory, and macro for the whole society or planet) provides a strong incentive to take a systems perspective. Last but not least, the heart of the model is based on the proactive management of the multiple stakeholders involved in the circular ecosystem. In fact, stakeholder representatives are invited to meet around BM³C² frameworks placed side by side in order negotiate, to collectively connect and align their respective BMs in the best possible way, according to CE principles. If Fig. 5 above and Fig. 7 below only represent two organizations, there is no methodological difficulty to connect and align more organizations.

5. Field testing and pedagogical case study

For space reasons we present only one experiment, the SMART³ case because due to its four-year duration we collected a large amount of data on it. It presents the following characteristics (i) a cross-industry R&D project involving multiple actors (Fig. 6), (ii) a complex and multi-level environment, and obviously (iii) circular flows.

³ Sustainability, Material, Agreement, Recycling, Together.

Let us now present the project (5.1.) the application and test of the BM³C² framework (5.2.), and the results from experiments (5.3.).

5.1. Presentation of the SMART project case

Plastic films are essential inputs in horticultural farming in the Nantes region (France). Polyethylene films stretched over tunnel arches protect seedlings and young shoots from bad weather and diseases and accelerate their growth (image 1).



Image 1. (a) Plastic tunnels in use and field after their removal, (b) Films removed, and (c) regenerated pellets (Authors).

At the end of their life the films are recycled. However, this solution involves “downcycling” films with high mechanical properties. Fig. 6 provides an overview of the life cycle of plastic films and the organization of their recycling once used, at the beginning of the SMART project. The complexity of the ecosystem and limited space make it impossible to comment this figure (please refer to Boldrini, 2020).

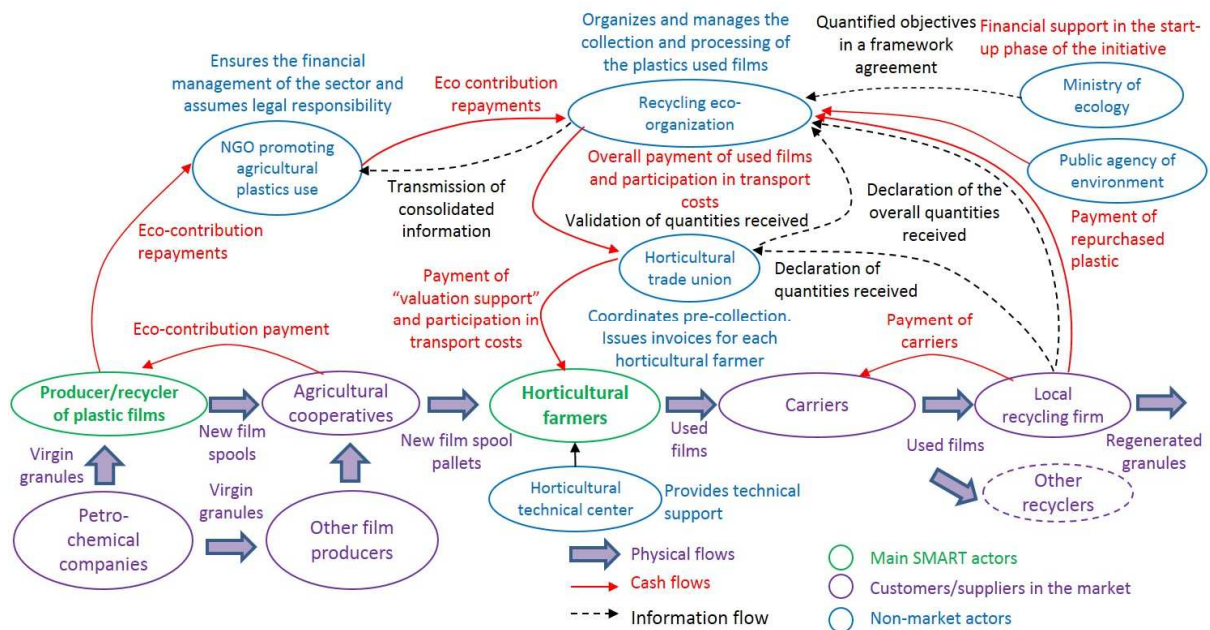


Fig. 6. The lifecycle of plastic horticultural films and the organization of their recycling (translated from Boldrini, 2020, p. 42).

SMART is a collaborative project which seeks to change this organization. Its novelty is that used agricultural films would be locally “isocycled” into new agricultural films and delivered back to the farmers instead of being “downcycled” as before. The justification for “isocycling” is that due to their high performance characteristics, in terms of tear resistance and transparency, they are the best recycled material out of which to make new agricultural films. Horticultural farmers and the producer/recycler of plastic films operate in very competitive environments. They have very little negotiating power with retailers and suppliers, respectively the central purchasing bodies of retailing firms and petrochemical companies. In this context, their key competitive advantages lie in their ability to cut costs while preserving the characteristics of their products. The aim of the project was to install a direct relationship between horticultural farmers and the plastic manufacturer/recycler, bypassing the existing collecting eco-organization. This idea helps limit the dependency on oil, one of the ingredients for polyethylene. It also shows a disconnection between the immediate interests of both parties (sell used plastics at a high price for farmers *versus* buy used plastics at a low price for the recycler).

After three years and despite the demonstration of the technical, economic and environmental feasibility of the project, the parties partially failed to cooperate in order to move beyond the experimental phase (Boldrini, 2020). However, this project contains a huge quantity of detailed and contextualized information which we used initially to develop role games, test the BM³C² framework, and identify key success factors. We were then able to use this knowledge to develop training courses and apply it to other cases presented in the Supplementary Materials.

5.2. Testing the BM³C² framework on the case

Fig. 7 is an application of our framework to the SMART case study based on a consensus reached by a group of students during one experiment. It also corresponds to the solution adopted in the real case. Table 3 in Supplementary Materials provide details on the schedule of this experiment.

The material provided for the experiment are⁴: (i) one video⁵, (ii) a six-page document presenting horticultural plastic films, the context of their use, their lifecycle, and their recycling, (iii) five role cards which define the psychological profiles and interests of the parties involved.

The example provided in Fig. 7 is a product-oriented Product-Service System. The product is the plastic film and the service the collection, recycling and delivery of film spools. This solution is not disruptive but it has two advantages. It is the easiest and least risky solution to start a transition to the CE and implement a CBM. In a pedagogical situation, this solution is easy to understand.

One example can illustrate the dynamic interactions needed to connect and align the BMs. When the experiment started, the washing lines were underperforming for soiled films. Progressively the recycler learnt how to improve its process but it was not enough. The farmers considered that their plastic was clean compared to mulch ones, while the plastic film manufacturer considered it dirty

⁴ <http://www.bm3c2.fr/index.php/project/isocyclage-films-plastiques-maraichers/>

⁵ <http://webtv.univ-nantes.fr/fiche/20217/triosmart-le-film-de-l-economie-circulaire-english-version>

compared to industrial used films. The negotiation of the acceptable soiling rate for each party and the effort it implied for each to respect it is a perfect example of the connections to be made between the BMs of two organizations.

Finally, Fig. 7 shows what the BM³C² could bring both organizations (50 % reduction in PE pellet consumption, stronger position on the regional market, more eco-friendly waste management for farms). There are higher level results (new local economic activity contributing to CE regional policy). However, the positive effects for regional firms represent a tiny fraction of the national consumption of plastics.

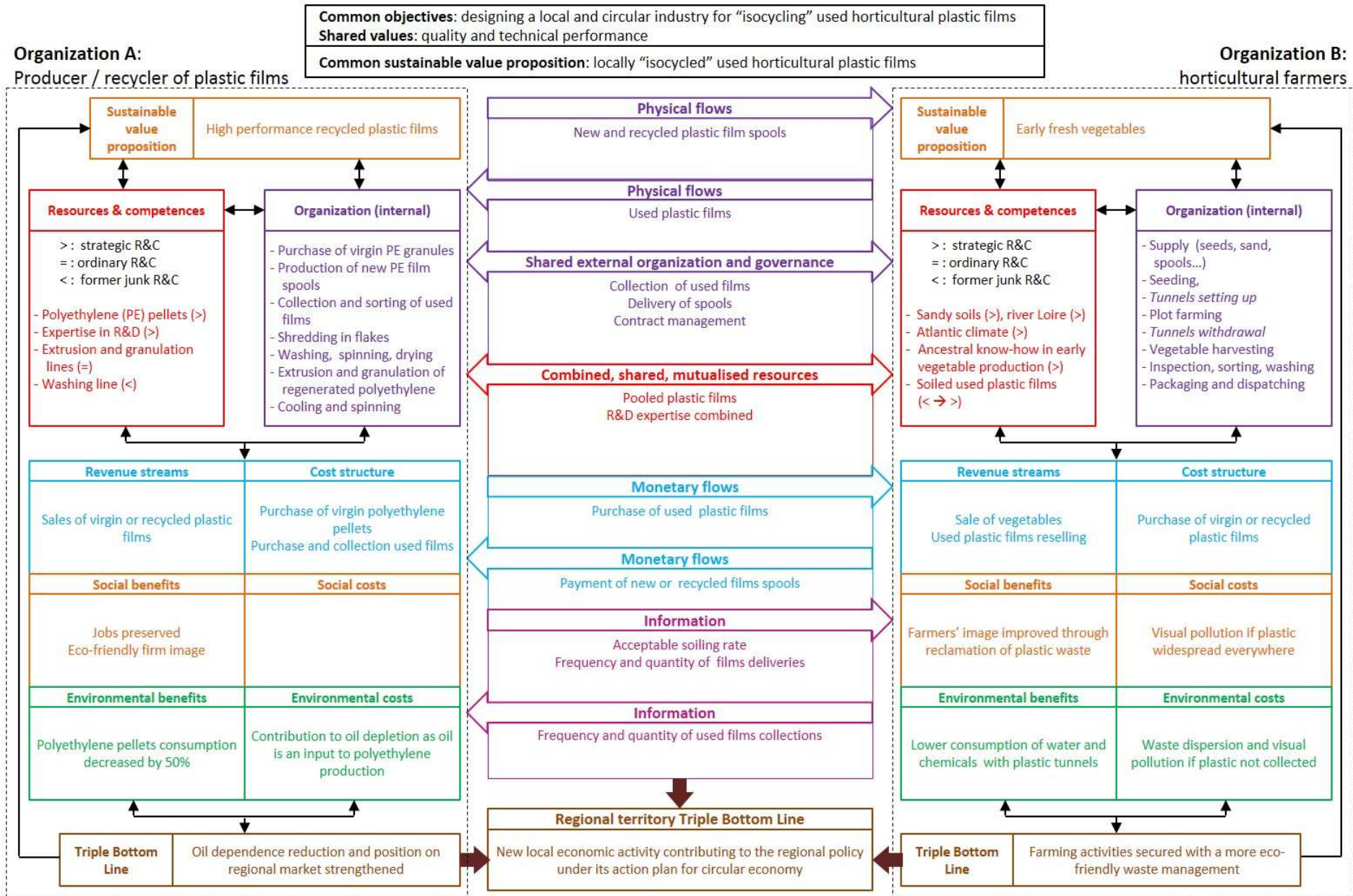


Fig. 7. Completed BM³C² framework between the producer/recycler of plastic films and the horticultural farmers (Authors).

5.3. Assessment of the pedagogical tests based on the users' feedback

The usefulness and ease of use of tools developed for circular innovation needs to be evaluated (Konietzko et al., 2020b). During the development of the BM³C² framework, regular assessments of the learning objectives took place through lecture-based evaluations, discussions with colleagues and external experts and consultants involved in the experiments (Karlusch et al., 2018). Not only did we build case studies but we also analyzed the 197 assessment sheets we collected across experiments. The main strong points that students and professionals identified after experimenting with the BM³C² framework are: "the involvement of all the actors concerned", "the exchange of different points of view" and their "diversity", "the meaning given to the collective project", "the enrichment of the analyses" thanks to "cooperation" and the "variety of competences gathered", "the systemic side of the reflection", "the conciliation, thanks to a tool, of the interests of different stakeholders", the construction of "reciprocal benefits", the "understanding of the interdependencies between actors", the possibility of "making new proposals with all the actors". Participants also noticed that the "model makes explicit the link between "strategy and circularity". They appreciated the ease of representing "in a schematic way" the "types of flows that link" the BMs "put in common" thanks to a "visual support" "quite easy to make [their] own".

As concerns facilitation, the participants found that the pedagogical approach allowed them to "work on a real-life case [making] the study interesting" and that the "real-life case well highlighted the issues at stake". The supervised group-work enabled good connections with "the theoretical notions seen" previously. The "brain stimulation" and "collective intelligence" allowed "the co-construction of a real project". The "interactions in the group", the "negotiation phases" and the need to "play roles" were considered "very enriching". The presence of "external participants", including the "partner organization", when possible, was also appreciated. Some workshops mixed students from different backgrounds. This was considered "interesting because of the crossover of disciplines". Some students expressed the wish to carry on using this model in the future.

The main reservations which were voiced concerned the lack of time, insufficient to take on a "complex topic" concerning a most often "unknown area". It was then difficult for them to "understand the actors' roles" and to carry out "a real reflexive work". Some students suggested we should give them a detailed schedule for the session. This document existed but was intended for facilitators. The "lack of [previous] knowledge about the sector" on which the collective work was based was also a difficulty. In this case, the students expressed difficulty in "thinking through the complexity of CBMs", in establishing "connections between the two BMs", in establishing "coherent links" between them, and in "reconciling non-convergent interests". It should be noted that professionals experienced the same difficulties and that one interest of the experiments was to make them aware of these difficulties. Participants were ambivalent about the inputs provided to them. Sometimes, they felt that the half-dozen pages of context presentation given to them represented "too much information to assimilate in too little time". Some also found that "information on the companies involved was insufficient". They would have liked to have more "financial data", in order to "be able to rely on facts". Thus, they were simply reflecting the reality of innovation projects, with a part of unknown. These comments testify to the proximity of the pedagogical situations with real life situations.

Nevertheless, the participants draw an overall positive assessment of the workshops. They had acquired a greater "open-mindedness", a capacity for "taking things to a higher level". As the experiments progressed, the participants suggested improvements: making available "a video presentation of the companies", providing "more information before the beginning of the session rather than during it", and takeaway material so that "important information can be kept" because "there is no time to take notes" during the workshop. These requests were met through the creation of a platform (www.bm3c2.fr) which offers various additional resources (tutorials, library of cases, trainer's guide...) to facilitate teaching BM³C² to students and appropriation by practitioners.

To conclude, we now have a rather good view of how to adapt the use of the BM³C² framework and of the platform in various contexts (time available, guidance to provide according the background

and previous knowledge of participants on CE and CBMs). This knowledge is useful both for teaching purposes, and for advising companies on how to apply the BM³C².

6. Discussion

This paper has presented a new CBM tool, BM³C². It aims to connect and align the BMs of multiple organizations involved in the CE. It is multi-level because it can link and encompass different units of analysis (from business unit to ecosystem) (Geissdoerfer et al., 2020). It takes into account the micro level (organizations), the meso level (their ecosystem), and the macro level (society or the planet). It is circular because it incorporates the CE principles. It is collaborative because the heart of its use is, in a value network, to guide multiple stakeholders to identify flows of products, materials, money and information and to negotiate and arrange the connections between their respective BMs in order to reach the best overall performance. The paper shows how a group of loosely-coupled organizations can interact and innovate to achieve a collective outcome (Konietzko et al., 2020b). Credence can be given to the model not only for its theoretical foundations but also because it has been tested many times and in various contexts (academic, professional) with hundreds of people. To obtain a parsimonious but comprehensive theoretical model (Whetten, 1989), we based the BM³C² framework on the RCOV model which claims exactly these characteristics (Demil and Lecocq, 2010). We then extended and enriched the RCOV model by incorporating CE and CBM principles. We developed the BM³C² framework because, despite an abundant literature on CBMs, there was no visual BM tool that explicitly showed the connections that allowed the alignment of the BMs of several organizations. The BM³C² is useful at least in two kinds of situations. In higher education, it can help teach CE and CBM principles and provide students with a first “hands-on” experience. In professional life, it can help consultants provide guidance in the transition to the CE. It provides a tool for practitioners who don’t know how to get started. The BM³C² is also useful for any collaborative innovation (open innovation, cross-industry projects). It can be used in a wide variety of pedagogical situations. It can also be valuable for real business cases.

Thus, the visual tool (Joyce and Paquin, 2016; Täuscher and Abdelkafi, 2017) that we designed and tested provides three main contributions to research, practice, and education. First, we claim it is a theoretical contribution on CBMs for circular ecosystem innovation (Demil et al., 2018; Konietzko et al., 2020a, 2020b). Second, it is a useful tool for practitioners and policy makers to implement CE strategies (Zaoual and Lecocq, 2018). Third, the BM³C² framework is a pedagogical tool for the education to CE and sustainability (Figueiró and Raullet, 2015; Leal Filho et al., 2018; Kirchherr and Piscicelli, 2019; Karlusch et al., 2018).

6.1. Theoretical contributions

The research proposes a new “reference model” (visual framework for representing CBMs elements) which supports both a static and a dynamic view of CBM innovation (Geissdoerfer et al., 2020). It brings new insights to the BM tools dedicated to the CE (Demil et al., 2018; Konietzko et al., 2020b). It demonstrates that a CBM approach, focused on potential connections and best alignments between several BMs (Zaoual and Lecocq, 2018), can allow the detection of new and positive relationships for sustainability. This can happen at many levels (organization, industry, region...). Thus, it can be conceived as a high level BM, made up of the interconnected BMs of the partners. This focus on connecting several BMs, and visualizing them, is a new contribution. Our model can also be used for creating new ecosystems, and help them evolve as connections between BMs are continuously changing (Demil et al., 2018). In this context, BM³C² puts creativity at the heart of strategy by helping users explore new sustainable value potential to collectively address higher sustainability issues (Joyce and Paquin, 2016; Demil et al., 2018; Konietzko et al., 2020b).

6.2. Managerial implications

As a generic tool, BM³C² embeds knowledge on the CE and CBMs. It facilitates the transition to the CE for practitioners and policy makers. However, whatever the theoretical robustness of a CBM, the success of its implementation relies on the outcome of negotiations between parties. Thus,

managing its application is crucial (Demil et al., 2018). Based on our numerous experimentations, we claim to have reached a good integration between CE and CBM theoretical principles, CBM design and even effective implementation because we acknowledged the importance of relationship and emotions which are rarely reported in the BM literature. This enables us to provide actionable advice to practitioners that is lacking in the literature but which is exactly what many of the practitioners are seeking (Kirchherr and van Santen, 2019). This could also encourage the transformation of production-consumption systems that scarcely consider the CE in their day-to-day operations (Camón and Celma, 2020).

6.3. Educational implications

Today's students will be tomorrow's professionals. They will face major environmental and societal challenges. The use of the BM³C² framework, allows them to gain a first “hands-on” experience in situations close to real cases. Perhaps an important outcome is not the acquisition of instrumental knowledge on CE and CBMs, but rather an awareness of the key roles that “matchmakers” play in facilitating new forms of inter-organizational cooperation (Zaoual and Lecocq, 2018). Through pedagogical situations, such roles can be experimented and also reveal the value, of “Lead Operators” to formally connect organizations, and of “Caretakers” to ensure trust and collaboration among partners (Zaoual and Lecocq, 2018).

6.4. Limitations and future research

One limitation of our model, as presented in this paper, is that it visualizes only two organizations. This is far from complex circular ecosystems such as the one represented in Fig. 6. There is no methodological difficulty to represent more organizations but there is a physical one due to the space occupied by many A2 format boards if many organizations are involved. This difficulty could be overcome with software. A system of layers could then be imagined to display various levels of

granularity as suggested by Brehmer et al. (2018). A second limit is that only participants become fully aware of the long and difficult process of CBM design and of its evolutionary and dynamic nature (Bocken et al., 2014; Täuscher and Abdelkafi, 2017; Rong et al., 2018; Bocken et al., 2018). Once the BM³C² is finalized these difficulties are hidden to people who have not been involved in the process. A third limit is that the paper only reports on experiments with a French audience: mostly graduate students and business professionals.

Three avenues for future research can be pursued. First, the study of the real business cases can be extended over time to analyze reciprocal interactions between circular ecosystem evolution and CBMs. Second, the nature of relationships, socio-cultural barriers, and psychological inertia should also be studied to improve cooperative and creative strategies. Third, as the CE ought to be understood from a global point of view, our model should be confronted with empirical work in emerging countries, a subject on which the CE literature is almost inexistent (Kirchherr and van Santen, 2019; Camón and Celma, 2020).

7. Conclusion

This article responds to gaps identified in the literature on CBMs: (i) connection and alignment between the BMs of stakeholders, facilitating collaboration, (ii) adaptability to complex networks, (iii) dynamism to adapt to evolving ecosystems, and (iv) circular ecosystem innovation. To address these gaps, we designed a visual framework which explicitly connects and aligns the individual BMs of several organizations. Indeed, BMs built separately by various parties visualize only one organization at a time and are usually never shared in order to facilitate the emergence of a collective CBM.

Since our model explicitly represents the BMs of the stakeholders involved, it can be considered as a BM of BMs. Contrarily to existing BMs which represent one organization only, when a change happens in the ecosystem it is easier to represent it in our model which takes a wider picture into account. Also, as BM innovation for sustainability or circularity is a process and not only an outcome, we respond to the need for process with the use of artifacts that can support collaboration and

introduce dynamism and adaptability. Our model is supplemented by a portfolio of tools such as videos, role cards, etc. which instigate circular/sustainable thinking. These artifacts facilitate interaction and decision making in the context of BM innovation. Contrarily to the majority of methods and tools, our model adopts a boundary-spanning perspective which visualizes where and how a sustainable value is created, transferred and shared at the micro, meso, and macro levels. As such we claim three contributions:

First, the BM³C² framework provides a theoretical contribution (Demil et al., 2018; Konietzko et al., 2020a, 2020b), by insisting on the need to think of CBMs as high level BMs which connect many individual BMs with one another. Second, as both a research-based and carefully field-tested tool, it is a useful visual aid for practitioners and policy makers (Zaoual and Lecocq, 2018). It helps organizations and their stakeholders progressively and collectively design, connect, align as well as evaluate their respective BMs in a cooperative and dynamic way. Third, it is a pedagogical tool for CE and CBM education. It helps students in higher education or practitioners understand CE and sustainability principles, and to actively apply them (Figueiró and Raullet, 2015; Leal Filho et al., 2018; Kirchherr and Piscicelli, 2019). We acknowledge the “normative value” of our theory. Our model is less about capturing reality than trying to create a new one, to see the world as it should be (Suddaby, 2014). Our pedagogical experiments also “legitimize knowledge” on CE and CBM (Suddaby, 2014).

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