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Eléonore Disse

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What does “sustainable value creation” mean? An ecological accounting approach to sustainable business models

Author: DISSE Eléonore, Mines Paris-PSL (CGS-i3, UMR 9217),
eleonore.disse@minesparis.psl.eu

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Abstract

To qualify the sustainability of organizations, the business model approach questions whether it is possible to identify "sustainable value creation" (Lüdecke-Freund, 2020). While the polysemous notion of value was already unclear, its sustainable nature adds a further definitional difficulty. What's more, business model approaches do not enable to precisely address the impact of activities on the values in question. Our aim is to help clarify the sustainable business model approach to company sustainability through the prism of CARE ecological accounting framework (Rambaud & Richard, 2015). Our conceptual approach consists in applying CARE concepts and methodology to an illustrative case study inspired by a real farm business. We highlight how CARE repositions the understanding of sustainability in terms of the ability of a business to preserve human and natural capital while creating value (i.e. selling goods or services to obtain money resources). This reading leads to identify value propositions that consist in providing services that preserve the client's natural or human capitals. While other value propositions ultimately refer to the company's own human or natural capitals preservation. Thus, “sustainability” in business models should be clarified at least between making its own production process sustainable vs. contributing to its client's sustainability. Relying on an ecological accounting framework help designing strategies and activities to reach capital's preservation objectives according to anticipated costs. In the end, such framework can be used to lend credibility to sustainability claims possibly opening the door to the capture of financing solutions or market opportunities.

Key words: ecological accounting ; value creation ; business models ; sustainable business models ; natural capital

1. Introduction

The EU CSRD (Corporate Sustainability Reporting Directive) came into force in January 2024 and provides a framework for harmonizing non-financial reporting. Among the information to be published, companies are expected to demonstrate “the resilience of their business model”¹.

The notion of “business model”, which is part of the everyday language of entrepreneurs, is of interest to management science scholars. An important work was carried out by academics in this field leading to classifications and definitions. While it is still not harmonized, traditional business model approach mobilizes the notion of “value” (Osterwalder et al., 2005; Teece, 2010; Chesbrough, 2010).

By adding the question of sustainability, research on “sustainable business models” have broaden the concepts of this pre-existing literature on business models and integrated those of sustainability. One analytical prism consists in moving from a definition of business model through their capacity of creating economic value, to their ability to create social and environmental values. The notion of “sustainable value creation” is thus gaining increasing attention and has been the subject of a special issue of major authors’ review in this field (Lüdeke-Freund et al., 2020). Creating sustainable value is becoming the goal of business to make them be sustainable. However, definitions still lack clarity, and it remains difficult to see how to design or evaluate business according to this “sustainable value creation”.

Sustainable business models share references and concepts with some socio-environmental accounting approaches. However, neither seem to deeply investigate traditional accounting to clarify the notion of value and value creation. Since CARE (Rambaud & Richard, 2015) is a socio-environmental accounting framework that extent traditional accounting principles to human and natural entities, we are interested to explore to what extent this ecological accounting approach can help clarify the concept of sustainable value creation also used in sustainable business models. Thus, our research question in this paper is the following:

What does an ecological accounting perspective bring to the discussion on sustainable value creation?

We seek to precise this research question trough 3 sub-questions:

- What are the theoretical assumptions about value and value creation in sustainable business models and socio-environmental accounting?
- What analysis of value creation and business sustainability is given by CARE ecological accounting?
- What could be CARE ecological accounting contributions to building sustainable business models?

We start by introducing the literature on sustainable business models and socio environmental accounting in section 2. Then, section 3 details our approach and method and describes our illustrative case study based on a French family farm. Section 4 explores the theoretical groundings of value creation and sustainability in sustainable business models and socio-environmental accounting. Section 5 consists in applying CARE conceptual framework and methodology to our case study. Before our conclusion, section 6 is a discussion on the relevance of sustainable business models and CARE ecological accounting regarding the question of sustainability in business.

¹ Directive (EU) 2022/2464 of the European Parliament : <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464>

2. Sustainable business models and socio-environmental accounting: dealing with sustainability and business

Each of the research field examined in this paper intends to deal with sustainable issues in a business context. However, they differ in their perspectives and objectives in line with their academic and practical field history that we introduce in this section.

Social and environmental reporting and accounting (SEA)

Social, environmental and sustainability accounting and reporting (SEA) (Gray, 2006) refers to a diversity of initiatives and approaches in the field of management interested in corporate social responsibility or corporate sustainability in general (Deegan, 2017). Among SEA, Gray distinguishes on the one hand “mainstream SEA” (Gray, 2010) such as Global Reporting Initiatives, Triple Bottom Line which do not question the goal of a firm which is to make profit. On the other hand, “accounting *for* responsibility” (Gray, 2010) lead to a renewed consideration of the company’s performance since the accounting and reporting system should not be centered on the company but on sustainable issues itself. In this latter type, new accounts and metrics such as eco-balance and ecological footprint must be implemented.

These diverse forms of SEA correspond to different visions of what accounting is. We can illustrate such divergence by considering two approaches of financial accounting: IFRS standards and traditional accounting.

On the one hand, Chiapello highlighted that IFRS² standards encourage a shareholder vision of the firm: thus, accounting is a mean of informing the investors on the firm’s market value (Chiapello, 2005). Moreover with IFRS, environmental or social issues are considered only if they lead to financial risks or opportunities: this corresponds to an “outside-in perspective” meaning that sustainable issues are considered only when they affect the financial performance of the firm (Rambaud & Richard, 2016). This corresponds to financial materiality. Conversely, an “inside-out perspective” on sustainable issues would systematically consider the impacts of a company on its environment because of its activity³. This latter “impact materiality” is absent from IFRS considerations on social and environmental issues.

On the other hand, traditional accounting corresponds to a more managerial utilization of accounting. This diverging conception of accounting can be related to an underlying conception of capital: indeed, whereas *capital* is seen as an *asset* in the IFRS framework, it is a *liability* in traditional accounting (Rambaud & Richard, 2015). This latter conceptualization of capital underlies a societal obligation to preserve (i.e. maintain) the capital. This gives traditional accounting a role in the “implementation of instruments to track its use and guarantee its preservation (Rambaud & Richard, 2015, p.98). From this understanding of capital (as a liability) and accounting’s role (preserving capital), Rambaud and Richard conceptualized an extension of traditional accounting to natural and social entities. This accounting model is referred to as CARE for Comprehensive Accounting in Respect of Ecology (Rambaud & Richard, 2015). As a type of SEA, CARE is consistent with “double materiality” since sustainable issues are not considered for their financial materiality only but also because of the

² IFRS (International Financial Reporting Standards) are international accounting standards implemented in 2005 supplementing IAS (International Accounting Standards) that exist since 1973. They are developed by the International Accounting Standards Board, a private association.

³ Financial materiality and impact materiality together lead to “double materiality” as introduced by the UE Corporate Sustainability Reporting Directive Article 19a(1) and Article 29a(1) of Directive 2013/34/EU “require undertakings to report both on the impacts of the activities of the undertaking on people and the environment, and on how sustainability matters affect the undertaking.” (https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ%3AL%3A2022%3A322%3ATOC&uri=uriserv%3AOJ.L_.2022.322.01.0015.01.EN.G)

company's biophysical impacts. Moreover, CARE rely on a strong conception of sustainability because each capital must be preserved without compensation according to specific thresholds. This is precisely because each capital is considered as a liability/debt that there is no accounting mechanism to compensate between these well identified debts (Rambaud & Chenet, 2021). CARE is closer to an "accounting for sustainability" (Gray, 2010) framework since it considers that sustainable issues matter as such. But more precisely, CARE emphases that organizations are a mix of natural and social entities that must be taken into *account* as capitals. In doing so CARE provides an ecological view of organizations. We will thus refer to this type of SEA as "ecological accounting".

Sustainable business models

The concept of "business models" (BM) emerge in the academic literature in the 1990s (Lambert & Montemari, 2017). Academics identified the necessity to define this concept since it was widely used by practitioners. However, there is no common definition of what a BM is (Lambert & Montemari, 2017) despite efforts of most cited scholars from literature on innovation, strategy and entrepreneurship: Magretta, 2002; Teece, 2010; Chesbrough, 2010; Zott & Amit, 2010. Though, a common point is the centrality of the notion of value. Indeed a BM consists in the "description of a company logic of value creation" according to different "components": *value proposition, value creation (delivery) and value capture* (Doganova & Eyquem-Renault, 2009, p.1560) that can be sum up according to Doganova and Equem-Renault:

"First, the value proposition clarifies what value is embedded in the offerings of the firm (e.g. Afuah and Tucci, 2001; Dubosson-Torbay et al., 2002; Magretta, 2002). Second, the architecture of value lists the partners and channels through which value is produced and delivered (e.g. Afuah and Tucci, 2001; Hamel, 2000; Hedman and Kalling, 2003; Timmers, 1998; Weill and Vitale, 2001). Finally, the revenue model is the bottom line of the business model: it translates the two former dimensions in costs and revenue flows (e.g. Dubosson-Torbay et al., 2002; Magretta, 2002; Weill and Vitale, 2001)."

(Doganova & Eyquem-Renault, 2009, p.1560)

BM were popularized among practitioners notably thanks to the Osterwalder, Pigneur and Tucci's canvas business model which aims at designing BM (Osterwalder et al., 2005).

In line with this traditional approach to business models, the field of sustainable business models (SBM) was initiated by Stubbs and Cocklin (Stubbs & Cocklin, 2008). They intended to integrate the sustainable development concept into BM. Other attempts to build conceptual framework against the notion of "ontology" was developed by Upward and Jones (Upward & Jones, 2016) while Bocken et al. (Bocken et al., 2014) reviewed literature and practices to build a typology consisting in 8 archetypes of sustainable business models. These archetypes are described according to their characteristics in terms of value proposition, value creation and value capture. SBM literature also contains operational tools and framework often derived and inspired by traditional literature on BM such as so called "ecocanvas".

Recently some major authors of the field of SBM, Lüdeke-Freund et al. (Lüdeke-Freund et al., 2020) pointed out that sustainable value creation lacks definition among SBM literature. They notice that many authors refer to the stakeholder theory and TBL perspectives. Such perspectives are also used in "mainstream SEA" approaches. However, the SBM literature, when considering similar SEA's tools and framework do not look at accounting concepts and systems properly.

These considerations lead to formulate our research question: **What does an ecological accounting perspective bring to the discussion on sustainable value creation?** Which will be investigated through the following sub questions:

- What are the theoretical assumptions about value and value creation in sustainable business models and socio-environmental accounting?
- What analysis of value creation and business sustainability is given by CARE ecological accounting?
- What could be CARE ecological accounting contributions to building sustainable business models?

3. Approach and method

The aim of this paper is to contribute to clarifying the concept of sustainable value creation and understanding sustainability in business with the help of ecological accounting.

Our approach is conceptual as our aim is to identify what characterizes the approach of value and value creation in SBM and SEA approaches and what are their conceptual and practical difficulties. By developing the ecological accounting perspective, we could see what it brings to the analysis of a business' sustainability. To do so, we mobilize an illustrative case study inspired from a real business encountered in an intervention-research project conducted by the author.

Methodologically speaking, the use of an illustrative case study (David, 2003) provides the reader with a better understanding of the theories and approaches discussed, here ecological accounting. We concentrate on CARE ecological accounting framework which is the one developed in our research project.

We base our discussion of SBM on the paper of Lüdeke-Freund et al. (Lüdeke-Freund et al., 2020) because it meets the aim of this paper since it looks for a clarification of the notion of sustainable value creation. More precisely we discuss the authors' proposal to analyze sustainable value creation by mobilizing a double perspective: the TBL perspective and the stakeholder theory perspective. The former implies to distinguish between environmental, social and economic values in line with sustainable development approach. The latter implies specifying the targets of these values.

Our epistemic position derives from our positioning in the accounting literature which is that of conditional-normative theory of accounting (CoNAM) introduced by Mattessich (e.g. Mattessich, 1995). Far from saying that accounting is neutral, CoNAM recognizes that accounting embed value judgements depending on its users and their goals. Thus, CoNAM acknowledges that any accounting system is "purpose-oriented" and that the means-end relations into accounting must be studied (Mattessich, 1995). It consists of unveiling the goals (and underlying value judgment) that accounting's users seek to reach and identifying available means that enable to reach these goals must be known.

In this paper we consider that SBM and SEA are means to deal with sustainability and business. According to our interest in CoNAM methodological approach we look for clarifying underlying assumptions of each framework studied. This leads to better reveal that any framework is design for a specific objective which explains its form (e.g. the mean) according to the goal (e.g. the end) of their designers and their value judgement.

We mobilize CARE as a methodological framework applied to our case study. According to CARE conceptual framework a *capital* is "a 'thing', material or not, offering potential uses in a business model, and recognized as having to be preserved over a certain predetermined period (Rambaud, 2015)" (Rambaud & Chenet, 2021). In our case study, we concentrate on the integration of *natural capitals* into the accounting information system of a farm. CARE also addresses social issues in terms of human capitals. Indeed, with CARE an entity is recognized as a capital according to three criteria: (1) there exists a concern about the preservation of the

considered entity; (2) there is a clear ontology (i.e. a qualitative and quantitative description of the existence) of this entity; (3) there exists a preservation process of this entity (i.e. consisting in a series of preservation activities) (Rambaud & Chenet, 2021). The methodological phases⁴ of CARE leads to the structuration of an income statement, balance sheet and annex that include natural and human capitals. Throughout these methodological phases, a biophysical analysis of the company's activity together with biophysical scientific information about the local situation of the ecosystems' states lead to identify the non-financial capitals that must be preserved at their *good ecological states*. Considering existing *preservation activities* lead to biophysical conclusions (is the preservation threshold respected by the preservation actions?). The financial expenses of existing and planned activities (necessary to reach/maintain good ecological states) make it possible to integrate this information into monetary documents. In the balance sheet, non-financial capitals are represented by the monetary costs of the preservation activities necessary to preserve their good ecological state. In the income statement, expenses of the year for preservation purposes appear.

Our illustrative case consists in a family dairy farm located in France (Normandy) with 200 hectares, 150 dairy cows and 3 workers (the manager of the farm, his son on its way to take over and an employee). In recent years, important attention was paid to reducing negative impacts on soils because of tillage that is nearly suppressed. Soil analyses have revealed an improvement of the organic matter content. Cows are fed by grazing or harvested forage and cereals. Pesticides are still being used but reduced thanks to agronomic practices that avoid their need (ex. crop rotations limit the vulnerability to pests thanks to the diversity of cultures; soil cover avoid the appearance of weeds).

We focus our analysis on 3 natural capitals according to the CARE conceptual framework. Table 1 provides a synthesis of the characteristics which lead to consider these natural entities as capitals in our case study. In this paper we will only broadly define their characteristics, assuming that expert interviews, legal and scientific documents regarding the ecological state of the region have provided enough data to describe those natural capitals. The capitals considered are:

- *Water capital*. European Union Water Framework Directive⁵ implemented by French public water actors such as water agencies are concerned by the water cycle and quality in each watershed. The region is especially concerned with water pollution to nitrates and pesticides because of the intensive presence of agricultural activities. Moreover, as water is being impacted by the farm activity, it is a capital to be preserved.
- *Soil capital*. Soils are not currently legally protected even if a European Directive is at work⁶. However, soils preservation concerns many actors since soils participate to human health and ecosystem life in general. According to local experts, soils are in a quite good state in the agricultural region of the farm but must be monitored since they are eroded in the neighboring region.
- *Biodiversity capital*. Our case study is not concerned with legally protected species that could be considered as specific natural capitals. Consequently, we will consider the impacts of the farm activity regarding the preservation of resources and habitats for non-cultivated and non-bred species which concerns regional politics on ecological corridors (French "Trame verte et bleue") and global wildlife conservation.

⁴ Available at : <https://www.cerces.org/methodologie-care>

⁵ Directive 2000/60/EC : <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32000L0060>

⁶ Soil monitoring and resilience directive is in progress in European parliament. A synthesis is available at: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/757627/EPRS_BRI\(2024\)757627_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/757627/EPRS_BRI(2024)757627_EN.pdf)

Table 1: Synthesis of the 3 natural capitals examined in the case study

	Preservation concern	<i>Bearer of the concern</i>	Capital description	Preservation process example
Water capital	Preserving water cycle according to the EU Water Framework Directive	<i>Public water stakeholders: Water agencies, local communities, ...</i>	-rivers hydromorphic -physicochemical quality -biological quality -chemical state -quantitative state	Target chemical pollutants reduction (including nitrates and pesticides), maintaining and enhancing wetlands and grasslands surfaces
Soil capital	Preserving soils degradation and improving soil health according to the in-progress EU Soil Monitoring Law	<i>Environmental NGO's, soil conservation farmers' associations, ...</i>	-type & surface -landscape connection -ecological state (physical, chemical, biological, hydrologic state)	Target enhancement of soil organic matter and biodiversity
Biodiversity capital	Preserving resources and habitats, ecological corridors according to the French "Trame verte et bleue" politics	<i>French national biodiversity office, Normandy biodiversity agency, ...</i>	-species diversity -species population	Target maintaining and creating wildlife living and reproducing environments and ecological corridors

After exploring in section 4 how is sustainable value creation considered in SBM and SEA, we mobilize this case study in section 5 to illustrate what analysis can be made of this business when applying CARE ecological accounting.

4. Theoretical background of value creation and sustainability in SBM and SEA

In this section we consider what theoretical conception of value characterizes traditional accounting and business models frameworks and their extension to sustainability issues in SBM, SEA and ecological accounting.

Ambiguity of value and value creation in accounting and traditional BM approaches

Value is a polysemous concept (Bourguignon, 2005): value can be used for measurement purposes in different units (monetary or physical); value can refer to the "use value" in economics sometimes evaluated with the "willingness to pay" of the customer; value can refer to ethical aspects to reflect what is "valuable" (from the user point of view, be it a customer, a citizen, an institution). Consequently, value varies according to the materiality (or reality) attached i.e. the value type; the point of view considered (recipient of value); its evaluation method.

Each approach mobilizes explicit or implicit theoretical perspective of value. A first look at financial accounting illustrates well the intrication between the type of value that is chosen and the purpose of the accounting system.

Insights provided by some authors (e.g. Biondi, 2011; Chiapello, 2005; Rambaud & Chenet, 2021; Rambaud & Richard, 2015) highlight underlying assumptions of some accounting frameworks regarding value and its target. On the one hand, "fair value" accounting systems such as IFRS consists in evaluating company's assets to their value market. On the other hand,

“historical cost” accounting systems such as traditional accounting, record assets at their initial purchase cost.

Underlying goals of a company in accounting frameworks can be broadly summarized in line with two organization theories: the agency theory characterizes IFRS standards and fair value accounting; while historical cost accounting is aligned with the entity theory (Rambaud & Chenet, 2021; Biondi, 2011). Indeed, fair value promotes the value of a company according to the investors/shareholders’ interests. While historical cost provides a more cautious evaluation method of the company’s assets, closer to a managerial perspective. In the end, value is from the point of view of the investor (or shareholder) in IFRS whereas value is closer to the point of view of the company-as-an-entity (which must perdure in time) in historical cost accounting systems.

Reprising Mattessich distinction (see section 3) between purpose and mean-ends relation in accounting, table 2 applies it to fair value and historical cost accounting systems. It highlights that these diverging interpretation of value and derived evaluation method serve specific purposes and actors.

Table 2: Financial accounting systems differ in their conception of value and valuation method according to underlying purposes. (Author’s synthesis of Rambaud & Richard, 2015; Biondi, 2011 following a CoNAM analysis (Mattessich, 1995))

Accounting system	Fair value accounting (ex. IFRS)	Historical cost accounting (ex. traditional accounting)
Accounting purpose	Evaluating the company’s market value (for investors/shareholders)	Following financial capital uses and reimbursement
Means-end relation in accounting	Evaluating assets with future net cash inflow (<i>mean</i>) comes down to assessing the investor’s gain (<i>end</i>)	Historical cost depreciation (e.g. planned depreciation of fixed assets) (<i>mean</i>) leads to save revenues for capital reimbursement (<i>end</i>) before profit is calculated

While fair value accounting prefers value for shareholders and historical cost accounting is closer to value from the point of view of manager, another recipient of value should not be omitted: the consumer (or user) to which the product (or service) is dedicated. Indeed, before emphasizing on the shareholder’s value, the 1980’s accounting literature associated the notion of *value creation* with the goal of a company to satisfy consumer needs (Bourguignon, 2005). In this view, specific measurements and indicators of metrics were to be developed so that this need could be correctly addressed by the company. Kaplan and Norton’s work on Balanced Scorecard was designed that way (Bourguignon, 2005). Creating value to satisfy consumer’s demand is still conceived as the core and goal of any business in traditional approach to BM (e.g. Osterwalder et al., 2005)⁷.

Apart from consideration for the customer and the shareholder, approaches influenced by the notion of *stakeholders* and *corporate responsibility* emphasized on other recipients that the company should also satisfy (Mercier, 2006). Consequently there was much more values to be considered depending on the target (Lepak et al., 2007). This view was reprised by SEA and SBM.

⁷ See also an eloquent definition of Teece (2010): « A business model describes the design or architecture of the value creation, delivery and capture mechanisms employed. The essence of a business model is that it crystallizes customer needs and ability to pay, defines the manner by which the business enterprise responds to and delivers value to customers, entices customers to pay for value, and converts those payments to profit through the proper design and operation of the various elements of the value chain. » (Teece, 2010, p. 191)

SBM and SEA: defining sustainable value creation with the help of sustainable development and stakeholder theory

Many SEA and SBM approaches were conceptually influenced by sustainable development (defined in 1987 in the Brundtland report of the World Commission on Environment and Development). In line with consideration for the 3 pillars of sustainable development, the Triple Bottom Line (TBL) consists in reporting on 3 different types of income thus revealing an environmental, economic and social performance of the company. Lüdeke-Freund et al. identify that a “TBL approach” is commonly used in SBM and encourage to mobilize such “perspective” when trying to define value creation since it enables to think about “multiple value creation” i.e. economic, ecological and social values (Lüdeke-Freund et al., 2020, p.69).

In addition, the stakeholder theory conceptually supported that a plurality of values must be created by the company to satisfy a wide range of targets. In this view, the company must consider a larger scope than shareholders only and its goals are enlarged to “[satisfying] the objectives of the various stakeholders and coordinate their interests (Evan and Freeman, 1988).” (Chauvey *et al.*, 2015 p. 5). This (non-unified) conceptual background underlies a lot of SEA proposals and SBM approaches.

Together with a “TBL perspective”, Lüdeke-Freund et al. (Lüdeke-Freund et al., 2020) makes of the stakeholder theory another perspective of defining *value creation* in SBM, referred to as *sustainable value creation*. To them, since there is a “value pluralism” questions like “for whom value is created?” and “who captures value?” should help distinguishing. To do so, these authors recommend listing every stakeholder of the company.

Trying to define sustainable value creation through the distinction between environmental, economic and social values on the one hand and a stakeholder identification on the other hand is relevant since it helps to defocus the definition of value creation in economic terms only and allows a more systemic analysis of the company’s activities.

However, we must consider some limits to such definition.

Firstly, assuming that the company must fulfill a diverse range of stakeholders as a means of creating “sustainable value” should not obscure the fact that some interests (and consequently some values) could be divergent not to say opposed and contradictory (Chauvey et al., 2015). As a result, it doesn’t seem sufficient to consider more values and more stakeholders to define that a company is sustainable and value creation alike.

Secondly, management scholars interested in sustainable science highlighted that sustainability is hard to define at the scale of a company. This is a notion which implies to consider sustainable issues at the scale of socio-ecosystems rather than a company (Whiteman et al., 2013; Ergene et al., 2021). However, such scale of analysis is not always considered in SBM or SEA proposals. Indeed, SBM and SEA literature often describe sustainability as a company achievement of an “economic prosperity” along with reducing negative effects or generating positive effects (Schaltegger et al., 2016). Sometimes the term “value co-creation” is used to indicate that social or environmental value is observed along with economic value creation.

As a result, we should remain careful when alleging that a business is sustainable and better define what lies behind this term. Let’s see what insight CARE ecological accounting’s framework and concepts bring to the question of value creation and sustainability.

CARE ecological accounting: back to traditional accounting concepts and enlargement to sustainable issues

Value creation is not an accounting concept as such but a more strategic one according to Bourguignon (Bourguignon, 2005). When trying to adapt value creation to accounting concepts, we should return to definitions like wealth (defined as assets less liabilities) and income (revenues less expenses) (Ijiri, 1986)⁸.

Thus, traditional accounting is more used to consider in an increase in wealth what we could interpret as “value creation”. In more details, sales are the only means to have an external entry of monetary values. This money can be used to “restore” financial capitals that were used (i.e. consumed) to produce goods and services: such restoration is monitored through accounting amortization and debt reimbursement. After this, a positive income leads to an increase in wealth in an equity account in the balance sheet. This increase can possibly be interpreted in terms of value creation as it goes beyond a simple financial capital restoration⁹.

When considering also debt on natural capitals, new financial resources (brought in by sales) should also be used to restore the non-financial capitals that were consumed during the production process. Their passage from a degraded state to a good state occurs during preservation activities and is associated with a *positive impact* (whereas capitals’ consumption corresponds to a *negative impact*). Including these liabilities into accounting leads to reimburse these debts in the form of preservation expenses before profit is calculated (Rambaud & Richard, 2015). Contrary to what happens to financial capital, this is not an increase as such that is targeted regarding natural capitals but their first and foremost preservation (i.e. conservation) which is far from being reached today according to environmental indicators’ degradation.

As such, value creation is not a traditional accounting concept nor an ecological accounting one. CARE is indeed designed to monitor multi-capitals preservation. At the very least, we can consider that positive impact on natural capital (equivalent to the reimbursement of the debt on natural capitals) corresponds to (re)generating natural values.

Similarly, the notion of “value co-creation” (and co-benefits alike) is not an accounting one. What traditional accounting can do, is identifying intentions and means to realize it (e.g. products or service production and resources consumed). Accounting do not register a value creation in *retrospect*. Consequently, if a company wants to specifically “enhance” natural or human entities (and calls it natural or human value creation), this is an activity as such (intentionally pursued) which itself consumed resources (whether financial, natural or human).

When it comes to the notion of sustainability, CARE conceptual framework leads to a specific analysis. This lies in the ability of a company to produce goods and services while reimbursing all capitals (especially non-financial) that are used for the production activities. In other words, this corresponds to analyzing the company’s ability to reimburse its financial, human and natural debts. CARE extends the solvency analysis of a company to natural and human capitals.

This definition of sustainability is about the direct impacts of the company’s production activities. But it integrates socio-ecosystemic references since natural capital states and preservation process are designed according to local biophysical references and analysis¹⁰.

⁸ In traditional accounting, income corresponds to flow accounts, and wealth to stock accounts.

⁹ “An equity account is intended to be regularly enriched by incomes, that is, beyond simple capital conservation.” (Rambaud & Richard, 2015, p.102)

¹⁰ This can be investigated thanks to “ecosystem-centric” accounting systems (see <https://www.chaire-comptabilite-ecologique.fr/Input-paper-sur-l-importance-et-la-relation-entre-les-trois-modeles-de?lang=en>)

Thus, CARE responds to sustainable management scholars' concerns mentioned above, about defining sustainability at a relevant scale. Moreover, CARE integrates such objectives' references at the scale of the company.

Regarding the connection of CARE to the pillars of sustainable development (i.e. the TBL perspective in Lüdeke-Freund et al., 2020) we must consider that CARE analysis of sustainable issues relies on the identification of natural or human capitals. Thus, sustainable issues are basically distinguished between “natural” and “human” issues. But each must be specified according to CARE’s *capital* definition.

Regarding the notion of stakeholder, CARE expresses first natural and human issues that must be defined in their ontological terms. Since a capital is defined when “a concern for its preservation exists”, then bearer of such concern (whether they be legal framework, citizens, ...) can be identified. Consequently, the stakeholder approach is not used to define “sustainable value creation” as such, but to organize the governance of sustainable issues. Identified representant of preservation concerns or experts in defining capital’s preservation and state become stakeholders that can intervene to help understanding and defining the issues or controlling preservation actions’ realizations (Rambaud & Richard, 2015).

5. Illustrative case study: analysis of a small farm business according to CARE ecological accounting

In this section we consider our case study to illustrate some principles and concepts of CARE ecological accounting.

CARE approach of the farm activities

First, the impact analysis of the activity leads to elaborate a biophysical accounting regarding the consumption of natural capital. In table 3 we make a simplified analysis by considering 4 main activities of the farm that are necessary to produce goods that are sold (milk, meat and crops): cropping activities as a whole; grasslands cultivation for forage; cows watering and cows grazing.

Table 3: Identification of direct negative impact of the activity on natural capitals (author)

	Soil capital	Biodiversity capital	Water capital
Cropping activities (planting, weeding, mineral fertilizing, harvesting)	Soil nutrients exportation, soil compaction	Limited habitats and resources, Potential harm because of pesticides and herbicides	Water quality affected by potential nitrates and pesticides leaching
Grasslands cultivation	No direct negative impact <i>Soil globally preserved and improved</i>	Habitats and resources depend on the species of the grassland	No direct negative impact <i>Water pollution avoided by grassland retention</i>
Cows watering	No direct negative impact	No direct negative impact	No direct negative impact <i>Water consumption concerns the drinkable water and not a direct pumping of the groundwater table</i>
Cows grazing	Soil compaction	<i>Not evaluated in this study</i>	No direct negative impact <i>Water can be polluted because of excrements. There is no river adjacent to the pastures</i>

To keep natural capitals in their good ecological state despite their consumptions, some specific actions are conducted. They generate positive impacts on natural capitals and CARE conceptual framework refers to them as *preservation actions*. Their goal is not productive in the sense that no good nor service is directly produced by such actions. Rather they aim at “reimbursing” natural capitals’ debt.

Other actions aim at limiting the negative impacts (i.e. the natural capital consumptions). These *avoidance actions* are still productive but with reduced negative impacts compared to a previous situation or sector-specific practices. Therefore, some of these actions allow to avoid preservation plans since natural capitals are consumed below a threshold that would necessitate their preservation.

Among farming activities we notice design principles that cannot be attributed to a specific action but mostly refer to choices in designing the production process to obtain long term and systemic effects.

Table 4: Design principles and specific avoidance or preservation actions to reduce negative impact or the generate positive impact on consumed natural capitals (author)

	Soil capital	Biodiversity capital	Water capital
Design principles of the productive process			
Crop rotation and diversity	Avoid nutrients depletion, avoid weeds or pests’ persistence	Avoid habitat and resource depletion Avoid pesticides and herbicides	<i>Not evaluated</i>
Soil covering	Preserve soil globally	<i>Not evaluated / Neutral</i>	Avoid water pollution
Non tillage soil management	Avoid soil life degradation	<i>Not evaluated / Neutral</i>	<i>Not evaluated</i>
Limiting the number of grazing cows	Avoid soil compaction	<i>Not evaluated</i>	NC
Planned actions			
Maintaining existing hedgerows	Avoid soil erosion	Preserve habitats, resources and paths	Preserve water circulation
Incorporating cow manure	Preserve soil globally	<i>Not evaluated</i>	<i>Not evaluated</i>
Alfalfa cultivation	Preserve (restore) soil structure, restore soil nutrients and organic matter	<i>Not evaluated / Neutral</i>	<i>Not evaluated</i>

Table 4 highlights that the productive process is designed to avoid some negative impacts on natural capitals. Considering first table 3 regarding impacts on biodiversity we can see that the main negative impacts on biodiversity are due to cropping activities because less spontaneous habitats and resources are available on cultivated areas and non-cultivated or non-bred flora and fauna can be threatened by herbicides and pesticides. However, table 4 shows that the cropping system is designed to limit such impacts since crop rotation and diversity (6 different species are cultivated) leads to fewer spatial and temporal imbalances. Moreover, this farm has specific planned actions. Biodiversity capital is especially preserved thanks to hedgerow maintenance operations (i.e. pruning, renew planting).

In case several natural capitals are targeted by preservation actions, their costs can be integrated into monetary documents according to an allocation rule. We will simplify our case by choosing

to attribute only one action per capital (see bold planned actions in table 4). Schematically this will lead to balance sheet integration as presented in table 5.

Table 5: Simplified opening balance sheet (author)

Assets		Liabilities	
Financial assets	1 000 k €	Financial liabilities	1 000 k €
Natural assets			
Crops and grasslands	25 k €	Soil capital	25 k €
Hedgerows	3 k €	Biodiversity capital	3 k €

CARE monetary balance sheet extends traditional accounting reading of the liability side as corresponding to *resources*, and the asset side as the *uses* of these resources. CARE balance sheet distinguishes financial capitals and natural capitals (and potentially human capitals). The monetary value of natural capitals corresponds to the amount of money of preservation actions according to their planned preservation. In our case, an amount of 25 k€ for soil capital correspond to “incorporating cow manure” and “alfalfa cultivation” actions over 5 years. These actions can be evaluated according to the cost accounting of the farm or local references provided by agricultural associations or institutions. Soil is used in the production process to generate crops and grasslands which are assets.

An imbalance between natural assets and liabilities on natural capitals in a sense that the natural assets are consumed at a higher rate than debts are reimbursed means that the farm remains indebted on natural capitals. This can have many sources: the preservation actions are intentionally not conducted; or there is no cash available to finance them meaning that the business models’ value capture is not adapted. Organizational difficulties can also occur (e.g. human workforce availability). Finally, such imbalance is a sign of unsustainability that could be addressed: by redesigning the productive process to limit negative impacts that generate this natural capital’s debt (e.g. avoidance strategy); or by finding more financial or human resource.

After this more in-depth description of ecological accounting, we discuss in next section potential inputs of CARE to clarifying SBM approach of value creation and sustainability.

6. Discussion: relevance and complementarity of SBM and ecological accounting. Ecological accounting helps clarifying sustainability claims

Instead of looking for a proper definition of what a sustainable value is (since value is an ambiguous notion, see section 4), biophysical accounting analysis specifies natural capitals consumptions in terms of direct negative impacts which enables to qualify the sustainability of the production process itself when interpreted in terms of capitals preservation and solvency (see section 5).

But we can also consider that some goods or services are designed to preserve (i.e. generate positive impacts) natural capitals used by the client. In terms of business models, it means that the company provides preservation goods or services that do not improve its own sustainability but the one of its client.

As a result, considering the “location” of positive impacts on the value chain can be useful to clarify SBM value proposition and sustainability claims. From a BM approach, value proposition consists in detailing what value is offered to the target customer (Bocken et al.,

2014). Ecological accounting enables to identify value propositions that consist in claiming a sustainable production process, for instance organic farming (see Fig. 1). Some other consist in selling a good or service targeting the client’s capital preservation (see Fig. 2). This last type corresponds to a *contribution* to making the client company sustainable by preserving its capitals.

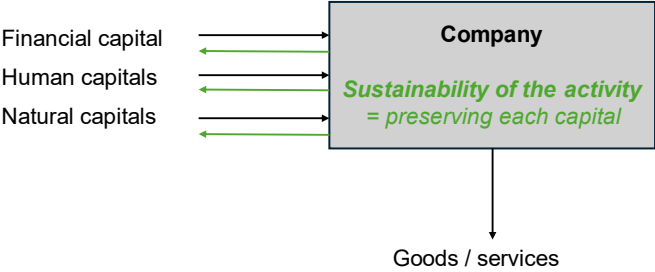


Figure 1: Sustainability defined as the ability to preserve all capitals

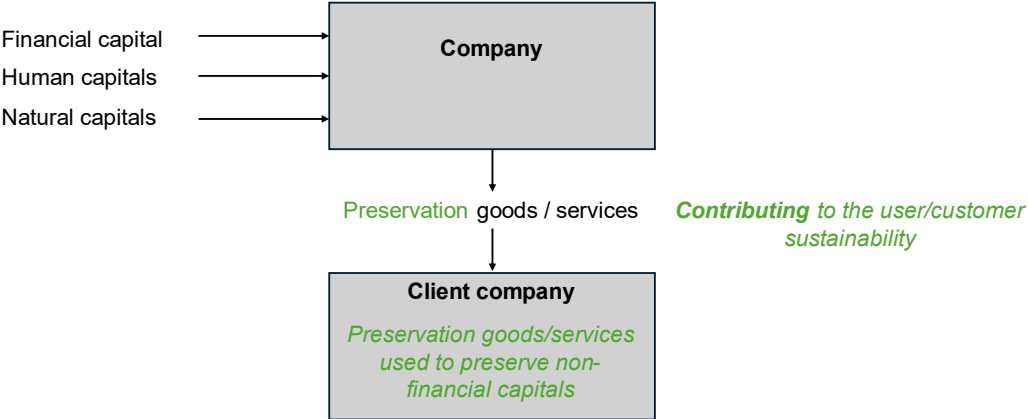


Figure 2: Contributing to the sustainability on its value chain

Thus, ecological accounting can be a mean to justify sustainability claims by specifying them in terms of location of positive impacts on the value chain.

Moreover, from a methodological point of view, an accounting framework set bases for a better definition of sustainability.

First, it sets the same rules for all companies. More specifically, each company must take into *account* its human and natural capitals consumptions. As a result, its (un)sustainability can then be defined as its (un)ability to preserve all financial, natural and human capitals used in its activities.

Second, an accounting framework enables comparison between companies which is almost impossible without harmonized information systems. This is specifically what motivates the EU CSRD. It avoids the difficulty encountered in SBM approaches which differ in their diversity of typology and classifications.

Ecological accounting helps designing sustainable business models

Ecological accounting highlights that well-structured preservation plans imply to intentionally dedicate financial and human resources to reimburse debts on natural capitals. In terms of business models, it means that the activity should integrate these (possibly new) needs in resources to the design of its activities and financing issues. Such analysis enables to see at the scale of a company if its business model generates enough revenues to finance the implementation of the natural capital preservation plan. If not, different reorientation can be studied:

- Avoidance strategy: consists in designing a business model that consumes less natural capital. This implies to modify the production process so that it is compatible with natural capital preservation (ex. buying a less weighted tractor to avoid soil compaction)
- Preservation strategy: consists in designing necessary preservation actions to make its business model sustainable. As a result, the current production process can remain unchanged if (and only if) it is biophysically possible to find preservation activities (implying that a threshold of negative impact is not crossed)

In each strategy (i.e. avoidance or preservation) the company must address the question of financing its activities (i.e. value capture in BM terms). An ecological accounting planning enable to anticipate financial costs and potentially brings proofs to conditioned subventions which could finance these actions.

Table 6 sums up some insights provided by CARE ecological accounting framework to the question of sustainable value creation and SBM.

Table 6: Synthesis of CARE insights to the discussion on sustainable business models

SBM notions	CARE ecological accounting reading
Value creation	Selling a good/service
<i>Sustainable value creation</i>	The company's activities can be considered sustainable when all capitals are preserved. Value is not sustainable as such, but the production process can be when debts on capitals are reimbursed (=solvency extended to non-financial capitals)
Value proposition	Claims about the good / the service
<i>Sustainability in value proposition</i>	Sustainability can qualify: -the production process itself (ex. organically grown wheat) -the contribution of a good/service (ex. planting hedge) to the capital preservation of the client
Value capture	Financing the company's activities
<i>Costs and revenue flows</i>	Designing activities to reduce negative impacts (avoidance strategy) or financing preservation actions (preservation strategy) leads to assessing costs or possibly new revenues in relation to the market opportunities (ex. bonus for labelled productions, subventions conditioned to production specification or transition)

7. Conclusion

While the notion of value in business models is not always well defined, management literature often refers to value creation as something positive and desirable (Lüdecke-Freund, 2020). Though, the polysemy of value becomes even more problematic when it comes to qualifying it in relation to sustainability, which is itself a notion with a variety of meanings. The approach to SBM studied in this paper mobilizes sustainable development pillars and stakeholder perspectives to try to define types and targets of value creation. However, such conceptual lens does not seem of a better help at clarifying value creation and sustainability in business. Thinking business through ecological accounting enables to ground the analysis in terms of

capitals consumptions (negative impacts) and debts reimbursement (positive impacts). This leads to a definition of sustainability regarding the ability of a company to preserve all capitals used in its production process. As a result, designing sustainable business models consists in obtaining enough financial resources so that preservation actions can be realized and natural capitals preserved. Such approach to sustainability can be translated into business models' language by clarifying value propositions claims on sustainability or by identifying value proposition that are goods or services designed to preserve a client's capital. Accounting system is still relevant to evaluate financial resources that are necessary, to plan and monitor natural capital preservation, or reorient the strategy if sustainability is hard to reach.

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