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# The “Triple Depreciation Line” instead of the “Triple Bottom Line”: Towards a genuine integrated reporting

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### ABSTRACT

The ‘Triple Bottom Line’ (TBL) is a major and increasingly used socio-environmental accounting framework. However, critical academic examinations of this model have been remained scarce and most importantly, no real alternatives have been developed. Thus this theoretical paper provides a contribution to fill this gap. Through a critical analysis of the TBL, we argue that it suffers from severe limitations. In particular, it does not protect human and natural capital (HNC). As an answer to these problems, we propose and discuss another accounting framework, the ‘Triple Depreciation Line’ (TDL), which extends to HNC the powerful capitalist accounting tool for preserving financial capital – the historical cost accounting (HCA) and its planned depreciation. To this end, we analyse and (re-)define the concept of capital in an ecological accounting context. We clearly specify the assumptions on which the TDL relies, to facilitate comparisons or dialogues with other accounting models and to avoid misunderstanding as in the case of the TBL. These axioms concern what we call the ‘social’ (axioms SA1–2) and ‘corporate’ (axioms AA1–4) capital maintenance. While the two first appeal to the most precise ontological investigation possible of HNC, the others imply mainly the recourse to the HCA and its depreciation.

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## 1. Introduction

The concept of the ‘Triple Bottom Line’ (TBL) was proposed by [Elkington \(1997\)](#) as a means towards sustainable development. Since then, the concept has gained tremendous notoriety not only among businesses, but even in other spheres such as agencies, consultancies, accounting professions and even NGOs (see, notably, ([Milne & Gray, 2013](#); [Norman & MacDonald, 2004](#); [Robins, 2006](#); [Savitz & Weber, 2006](#))). However, while countless works have praised the TBL model, amazingly, few have criticised it. Thus, [Norman and MacDonald \(2004\)](#) regret the “*surprising passivity of academic analysis*” which induced them to “*fill this academic lacuna*”,<sup>1</sup> focusing on the TBL model’s lack of originality and technical problems, like its difficult (if not impossible) use in valuing the social line. Since 2004, critical authors have written few articles on this topic, while other works have been published by TBL model’s defenders – notably a book of three hundred pages entirely devoted to this model ([Savitz & Weber, 2006](#)). Nevertheless, two significant contributions to the critical analysis of the TBL model

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<sup>1</sup> Before this, [Dyllick and Hockerts \(2002\)](#) marginally treated the TBL model. Despite the many doubts about TBL integration, they seemed to consider the TBL model rather favourably owing to its three interrelated dimensions of sustainability.

exist. Firstly [Robins \(2006\)](#) pointed out that the “*primary consideration*” of financial performance is hidden behind the apparent equilibrium between the economic, social, and environmental dimensions of the TBL model. Secondly [Milne and Gray \(2013\)](#)<sup>2</sup> underlined the danger of confusing sustainability with the TBL framework, notably because the latter is not associated with the systematic recognition of scientific limits that allow respecting the natural capital’s carrying capacity. In addition to the lack of critical studies, to our knowledge, none of the rare critics has proposed an alternative to the TBL framework. Thus, [Milne and Gray \(2013\)](#) ended their analysis of this model by appealing to “*reconceptualise*” decision making and the “*notion of success*” – without themselves promoting a clear competitor to the TBL model in business management.

This gap in the literature motivated our study. First, in Section 2, we conduct a short critical analysis of the TBL framework, highlighting its limitations, particularly that it does not protect human and natural capital. Then, in Section 3, we offer an alternative to the TBL accounting framework – the ‘Triple Depreciation Line’ (TDL) model – which overcomes the TBL framework’s issues. The TDL model can be seen as a theoretical development and an extension of [Richard’s \(2012a\)](#) CARE<sup>3</sup> model (see Section 3.3.1). We articulate this accounting model around three ideas. First, as human and natural capital protection is at the core of the TDL model, we examine and precisely define the concept of capital in an ecological accounting framework (see Section 3.1). Second, we argue that planned historical cost depreciation (HCD; see Section 3.2), which was intended to guarantee financial capital protection, has to be generalised to human and natural capital. Third, we develop the more general idea that an original ecological accounting model needs clear assumptions (axioms) to enable its analysis and comparison with other accounting models. The axiomatisation of the TDL model and its implications, like the utilisation of the HCD, on how this model is structured are presented in Section 3.3. Finally, we analyse the TDL model by examining its main consequences, comparing it with other related accounting models, and commenting on its structure and potential implementation (see Section 3.4).

## 2. Analysis of the TBL model

### 2.1. What is the TBL model?

One of the major difficulties related to Sustainable Development is defining it. Many scholars have already stressed that the well-known Brundtland definition of the concept is so vague that many other different interpretations of the concept could be derived from it ([Daly, 1990](#)). The TBL model faces the same issue. As [Norman and MacDonald \(2004\)](#) noted, ‘*there is no careful definition of the concept*’, ‘*only vague claims about the aims*’ ([Norman & MacDonald, 2004](#)). This imprecision is, however, one of the main reasons for its success: it gives firms the opportunity to make people believe they are pursuing one objective when in fact, they are pursuing a different one. In the next subsections, we provide an overview of the TBL’s appearance, then show that it has two main different versions.

#### 2.1.1. The appearance of the TBL model: equal conservation of three types of capital

[Elkington \(1997\)](#) presents the TBL framework as a key sustainability concept that promotes “*environmental quality, and – the element which business had preferred to overlook – social justice*” ([Elkington, 1997](#)) instead of exclusive economic prosperity. This concept has been popularised as the ‘three pillars’ approach, which has an important effect on the concept of capital. [Elkington \(1997\)](#) concluded logically that within the TBL philosophy, “*the concept of economic capital will need to absorb much wider concepts, such as natural capital and social capital*” ([Elkington, 1997](#)). Thus, seemingly, at least three types of capital, not only economic capital, are to be protected: this is why a Triple Bottom Line is needed, in order to check the reality of preserving the three types of capital. At this stage, the reader could be persuaded that the TBL model is a systematic conservation instrument for the three types of capital: a revolution in the management philosophy! This belief is supported apparently by the fact that Elkington presented its innovation as three parallel (bottom) lines of equal importance presumably indicating a reality of respect for the different types of capital (see schedule page 73 in ([Elkington, 1997](#))).

However, this presentation is misleading. We will show that the TBL framework does not intend to systematically conserve natural and human capital. At best, the focus is on only a possible decrease of their absolute degradation (if we take for granted that on the whole, the states of natural and for a large part human capital today is unsatisfactory). But according to another interpretation of the TBL model, it could be even more deceitful, allowing for increased degradations. We first discuss the optimistic case.

#### 2.1.2. The optimistic version of the TBL model: a possible decrease in the absolute degradation of natural and human capital

[Savitz and Weber \(2006\)](#), most notably, promote this version of the TBL model, despite recognising that the “*financial bottom line is not the only one or even the most important measure of success*” ([Savitz & Weber, 2006](#)). They position the TBL

<sup>2</sup> [Gray and Milne \(2004\)](#) identified two criticisms of the TBL framework: on the one hand, due to the pressure of the capitalist system, “*a company must be managed for the financial bottom line*” except if there are “*zones of discretion [...] where there is no apparent conflict with the financial*” especially within the frame of a win-win situation ([Gray & Milne, 2004](#)); but, on the other hand, “*what social and environmental reporting, the TBL or otherwise, cannot tell us is the extent to which the organization is contributing to, or detracting from, sustainability*” ([Gray & Milne, 2004](#)).

<sup>3</sup> Comptabilité Adaptée au Renouveau de l’Environnement.

model under the umbrella of profit creation for shareholders. According to them, a sustainable corporation is “one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts” (Savitz & Weber, 2006). This definition clearly implies that a decision to take measures in favour of improving the absolute situation of natural and social capital will not decrease shareholder profits. This has been confirmed not only by numerous examples of firms that apply this management approach,<sup>4</sup> but also by the recognition that a ‘win–win’ strategy is not always possible. In that case, it is “impossible for a company to act against its own financial interests” (Savitz & Weber, 2006). A Venn diagram illustrates this TBL interpretation; Savitz and Weber (2006) have recourse to only two overlapping circles symbolising the conjunction of shareholder and stakeholder interests (p. 23), but more often the representation is based on three overlapping circles symbolising the case that demonstrates it is possible to preserve the interests of the three main types of capital. Savitz and Weber (2006) express the belief that “sustainability enhances profitability for the vast majority of companies” (Savitz & Weber, 2006).

### 2.1.3. The pessimistic version of the TBL model: a possible increase in the absolute degradation of natural and human capital

The optimistic version of the TBL model is founded on the possibility of decreasing the absolute amount of environmental impacts. This conception is generally qualified as aiming to raise “effectiveness”.<sup>5</sup> The other possible version of the TBL model, however, is based on the concept of ‘eco-efficiency’. In his seminal book, Elkington, unlike Savitz and Weber (2006),<sup>6</sup> gives a fundamental role to eco-efficiency in constructing the TBL model. According to him, the development of the concept of eco-efficiency allowed the development of the TBL model, a framework that he believes can save businesspeople from ecological communism as these eloquent quotes show: “like the ancient Trojans dragging the vast wooden horse through a great gap torn in the walls of their long-besieged city, some of the world’s best business brains spent the 1990s struggling to take on board the emerging sustainability agenda. Many of their colleagues warned that success would end in disaster, just as it has done for the Trojans. Sustainable development, they argued, was a treacherous concept; basically, communism in camouflage. By the middle of the last decade of the 20th century, however, their fevered brows were being soothed by the concept of ‘eco-efficiency’, promoted by the World Business Council for Sustainable Development (WBCSD)” (Elkington, 1997).

As we have said before, Elkington’s TBL model representation equally prioritises three parallel lines, but this representation is misleading. As a matter of fact, Elkington insists that “some of the most interesting challenges [...] are found not within but between the areas covered by economic, social, and environmental bottom lines” (Elkington, 1997) and that “one area where we see a growing degree of overlap between a company’s economic and environmental performance is ‘eco-efficiency’” (Elkington, 1997). These statements suggest that the TBL model can and must be based on the eco-efficiency concept. Again we face a challenge, because eco-efficiency has many potential definitions. However, if we take into account those definitions linked with a proposed concrete measurement, we find that “eco-efficiency brings together the two eco-dimensions of economy and ecology to relate product or service value to environmental influence” (Verfaillie & Bidwell, 2000). In other words, it can be represented as the ratio Product or service value/Environmental influence. Although the numerator and denominator can be calculated in different ways, the main fact is that we deal with a ratio and not an absolute number as a goal for management. In other words, the focus is not on effectiveness but on efficiency. It is also possible to use mixed data with the denominator expressed in terms of prices and in terms of quantities. This solution is advised for higher managers: “the product manager could calculate an indicator on the basis of economic value per kilo joule of manufacturing energy consumed” (Elkington, 1997).<sup>7</sup> If such a definition of eco-efficiency is taken as the basis of the TBL model, a considerable change in comparison with the previous philosophy exists. It can be proved that the TBL model can show a positive picture, in spite of environmental degradations as expressed in absolute terms. This is because of the well-known rebound effect (Herring & Sorrell, 2009).

Thus, we conclude that the TBL model based on eco-efficiency is not a guarantee of progress for environmental issues. In fact, it can result in increased degradation. Contrary to the hopes expressed by Elkington (1997) eco-efficiency will not save capitalism.

## 3. An alternative to the Triple Bottom Line: the Triple Depreciation Line

Promoters of the TBL model insist that in the ‘changing course’ (to take an expression used by Schmidheiny and the Business Council for Sustainable Development (1992), the novelty is to consider conserving at least three types of capital: not only financial (or man-made) capital, but also natural and human ones. However, the only capital that the TBL model systematically protects is financial capital. Thus, as our starting point, we ask: Why not take the existence of different types of capital seriously and apply the same instruments of protection, historically used for financial capital, to all of them? In

<sup>4</sup> For example, according to the DuPont Commitment Safety, Health and the Environment (2013), E. I. du Pont de Nemours and Company is “creating shareholder and societal value [...] while reducing [its] footprint throughout the value chain”.

<sup>5</sup> Environmental effectiveness consists of reducing the total environmental impact as measured in absolute quantities.

<sup>6</sup> References to the concept of eco-efficiency are few; Savitz and Weber (2006) referred to it in pages 34 and 35 with an example of eco-efficiency in the Swiss firm ST Microelectronics inspired by Holliday et al. (2002). In this example eco-efficiency clearly appears as a ratio comparing profit and impacts on environment.

<sup>7</sup> In the same vein, “process engineers may want to evaluate eco-efficiency in terms of the number or mass of products being manufactured. Financial analysts or business managers may want to analyse eco-efficiency in terms of a company’s total turnover or earnings to assess economic risks/benefits” (Elkington, 1997).

order to answer this question, we first return to the notion of capital, which is a central concept not only in the TBL model, but also in accounting and ecology. We believe preserving a given capital involves a precise understanding of *what* must be preserved and what are at stake. Next, we study the main instrument for conserving financial capital in accounting: planned depreciation. We then propose and discuss an alternative accounting framework, the TDL model. We present this framework's axioms to enable comparison with other frameworks.

### 3.1. The concept of capital

#### 3.1.1. Capital from a social point of view

In this article, we do not want to (re-)open the Pandora's Box of capital ontology. We just want to obtain a working definition of a capital consistent with an ecological accounting approach. What is a capital is a central question notably in economics or accounting and remains a significant issue. Besides a traditional sense, the concept of capital has been used in several domains (see, for instance, the work of Bourdieu on cultural capital). The ideas of Sustainable Development and Corporate Social Responsibility (CSR) have finally imposed a prevailing structure on today's stakes in sustainability in terms of capital<sup>8</sup> and capital preservation (Pearce, 1988). This structure relies on an adaptation of capital's historical conception in new areas to produce an expanded definition(s) of capital, as was also proposed by Elkington in the TBL model. However, different kinds of capital have their own definitions, and thus, capital seems to lack a global conceptualisation that encompasses the financial, human, and natural capital. This limitation could impede the development of a systematic and normalised approach to sustainability, notably in accounting.

From a mere traditional economic view of capital, a distinction is generally made first between business and social interpretations of the concept of capital (Marshall, 1920; Fisher, 1919). The first type is trade capital, while the second can be structured around two main ideas: capital as a stock of things “of limited life which are periodically worn out or used up and reproduced” or capital as a fund “which is maintained intact though the things in which it is invested may come and go to any extent” (Knight, 1935). The first meaning is called *materialist* by Hicks and the second one, *fundist* (Hicks, 1974). Georgescu-Roegen (1977) also used this distinction to structure his approach to ecological economics, which he generalised to natural capital: some natural capital are stocks and so can create flows at any rate (like non-renewable resources), while others are funds, like renewable resources. The latter kind of natural capital is a set of “durable instruments of production which are used as an indivisible entity over and over again in a temporal sequence” (Pekkarinen 1979). Moreover, they can generate services at a fixed rate, which is a characteristic of a fund and how it is used. According to Hicks, the main issues concerning the comprehension of the concept of capital stems from the dichotomy between these two points of views. Finally, after decades of controversies, a stabilised albeit still disputed definition of capital in traditional economics was given by Hulten (1991): “Two aspects of capital (including human capital) differentiate it from a primary input like labor: capital is a produced means of production, and capital is durable.”. Even if this definition does not incorporate more recent developments on the notion of capital, specifically non-produced capital, two central points are common in Georgescu-Roegen's approach. First of all, capital has the power to produce goods and services and thus, to *increase the wealth* of society. In fact, from a very broad point of view, “capital has effectively become a synonym for anything of value, whether or not it is economically quantifiable.” (Taylor 1996). Besides, capital is *durable*. More precisely, the anthropologist Paine (1971) claimed that his “working definition of capital is a resource in respect of which one controls its reproductive value. [...] The] distinction between resource and capital [is] seen as reposing in the matter of control over reproductive value.” (Paine, 1971). Thus, in accordance with the definition of Hulten (1991), capital, from a social point of view, is a resource (something that can provide valuable services) that can be maintained somehow. Let us now focus on the concept of *durability* associated with the concept of *controlled reproductive value*.

If we want to control a resource's reproductive value and thus, durability, we need to compare the states of this resource over time. Since controlling also means monitoring and assessing, and durability is associated with the concept of identity, we need to monitor the resource to determine whether or not it changes over time and thus, whether or not it is durable. This assessment can be based on a set of indicators, in which case, the resource's identity is reduced to a list of particular quantities. From a more general perspective, checking the preservation of something's identity involves ontological<sup>9</sup> assumptions on and investigations of that thing. In our example, the ontological examination of a resource is limited to scientific indicators, which correspond to a specific ontological assumption: reality can be described in mere objective scientific terms. This ontological investigation can also be based on subjective assessments like the evaluation of consumers' willingness to pay through market or contingent valuations in the neoclassical model.

Moreover, durability does not mean eternity, so durability has to be associated with a period of time. Similarly, according to the System of National Accounts for 2008,<sup>10</sup> a good is said to be durable if it “may be used [...] over a period of more than a year”. Therefore, a resource cannot be durable forever, but can be durable over a given period, depending on resource characteristics according to its ontology as described before.<sup>11</sup>

<sup>8</sup> See, for instance, (Stern, 1997) or (Sullivan, 2014) for a discussion on the relevance of the notion of (economic) capital in an ecological context.

<sup>9</sup> Ontology is the “branch of philosophy that deals with the nature of existence.” (Lukka, 1990).

<sup>10</sup> Available online from <https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf>.

<sup>11</sup> For instance, “pasture land has always been perceived as having intrinsic time of use and recovery time” (Bastianoni et al., 2012).



Now, a resource can have an intrinsic capacity to remain the same according to a particular ontology over a given period and thus, has the capacity to regenerate itself even if it is used. But does this capacity ensure that this resource is a capital? To a saw-mill, who is not concerned with preserving a given tree, but rather with the number of mature trees in a forest that it can log, a tree is not capital but merely a resource. However, as the forest has the capacity to keep the same number of trees, it can eventually be considered by the saw-mill as capital (here, the ontological description of the forest relies on the number of trees). This example illustrates that even if a resource can maintain itself (a tree in this example), it is not necessarily capital. It means that the notion of capital is associated with a concern to preserve a resource that has the capacity to be maintained over a period of time. In fact, if we come back to Paine's, controlling something involves, at least, an actor's concern. Similarly, land as an element of capital has been disputed by many economists (Marshall, 1920), who considered it to be a simple factor of production, freely given by nature and not intended for preservation. Land was recognised as a genuine element of capital in 1988 (Pearce, 1988) when some actors (scientists, NGOs, etc.) pointed out the importance of their existence and preservation. Thus, we can claim that land acquired a genuine statute of capital when it became a "matter of concerns"<sup>12</sup> (Latour, 2005). In the same way, a capacity for exchange is considered to be capital because someone, its owner, decides to preserve it; otherwise, this capacity is simply a resource: e.g. money as a gift is not necessarily a capital but a mere resource.

Therefore, the recognition of capital from a social point of view involves an ontological positioning and examination of the concerned resource, the delimitation of a temporal period of (re-)assessment based on the above ontological specifications (a period that depends on the intrinsic characteristics of the capital concerned) and a concern for the capital's preservation. Furthermore, as a resource is merely an available capacity (or a set of available capacities) (Verstraete & Jouison-Laffitte, 2011), we propose a comprehensive definition of a resource and of capital from a social point of view:

a resource consists of a capacity (or a set of capacities) directly available for use, while capital is a capacity (or a set of capacities) recognised as having to be maintained over a predetermined period.

The ontological positioning is implicitly contained in the concept of maintenance, while the terms 'recognised' and 'having to be' refer to the concern in this maintenance. Therefore, a financial resource is merely available money and thus, is a capacity of exchange. Related to this idea, the concept of a natural resource encompasses several types of capacities, like agricultural production or livestock farming. Moreover, Daly (2006) defines natural capital as "the capacity of the ecosystem to yield both a flow of natural resources and a flux of natural services." (Daly, 2006). In the same way, human capital can be defined as a capacity: a capacity of people "to be creative and to think, dream, and develop new ideas" (Audretsch, 2007) or more generally, "to accomplish their goals" (Chapin, Folke, & Kofinas, 2009). Let us specify that a capacity can be instantiated in a physical or immaterial entity: for instance, a banknote or a diamond can be an instance of a capacity of exchange, while a battery can be an instance of energy capacity.

Using this conception of capital, we note that a resource cannot be considered as capital without actors attaching an ontological description to it and having a concern to preserve it over a given period according to this ontological specification. These actors can be called the representatives<sup>13</sup> or spokespersons of the capital<sup>14</sup> (Latour, 2004a). A significant issue may appear when these representatives are not explicit or legitimate. However, this problem does not happen as far as financial capital is concerned, because this capital has an objectively accepted description based on monetary value and its preservation is a private affair of clearly identified and legally recognised agents; only the temporal period can be a matter of disagreement, notably because of possible changes in monetary units, due to inflation, for instance. In general, the association between capital and representatives is a much more political, ethical, and complex problem.

The primary concern with preserving a resource is an obvious and crucial classical problem in sustainability, and its resolution is clearly a political, ethical, and/or technical issue (Randall, 1994). The ontological examination of a resource also creates strong conflicts. As we mentioned before, the description of a resource can be based on pure subjective assessments (an altruistic consumer can be a representative of the capital concerned, for instance) or on more objective scientific

<sup>12</sup> These "matters of concerns" may vary, and we highlight that we do not predetermine in the TDL model what they should be (social assumptions 1 and 2 [SA1 and SA2], introduced in Section 3.3.1, only express minimal requirements in order these matters to get a genuine sustainable orientation).

<sup>13</sup> We give some examples of possible representatives for several types of capital in Appendix A.

<sup>14</sup> Although these spokespersons are human beings, this conception of capital does not involve anthropocentrism (Whiteside, 2002) and/or utilitarianism (see also footnote 12): there is a difference between representing given entities and thus, giving them the ability to 'speak' and viewing them as human means. It is only a pragmatic approach of what capital is in financial and extra-financial situations.

For instance, as far as environmental ethics is concerned, this approach corresponds to a pragmatic shift (Weston, 1985) from the search for an intrinsic value (see also footnotes 23 and 24) of some natural entities to a pragmatic and more concrete approach of human/non-human relations (Forsyth, 2003; Latour, 2004a; Whiteside, 2002). We point out that this positioning does not correspond to a predetermination of the nature of the political and ethical management of socio-environmental capital: some researchers suggest that this pragmatic approach can in fact converge to Deep Ecological principles if environmental entities are 'matters of concerns' (see the 'convergence thesis' of Norton (1991)). This suggestion is in line with strong sustainability principles and SA1 introduced in Section 3.3.1.

indicators (scientists become representatives of the capital concerned). Environmental entities like biodiversity, climate, and in general, Complex Adaptive Systems “imply a different relationship between the observer and the system than that we usually assume when doing traditional reductionist scientific analysis. [...] The boundaries of the system to be studied are not determined by the structure and dynamics of the ‘external’ system itself, but by the query which one poses. [...] While] particular ontologies may indeed be adequate for specific studies or research areas, no single ontology is sufficient in itself to capture a dominant totality of what actually exists” (Allenby, 2005).

This situation obliges a shift from normal science to post-normal science (Forsyth, 2003; Funtowicz & Ravetz, 1991), where pragmatic deliberative ontological enquiries of the entities concerned are necessary to be able to “articulate” (Latour, 2004a) ourselves with them and to manage and/or protect them (Latour, 2004a). This point of view entails developing new institutional apparatuses (Brown, 2009b) that could effectively tackle sustainability issues (Latour, 1993, 2004a). This conception also involves a new type of rationality (Faucheux, Froger, & Noel, 1995) and legitimacy not only based on the skills of the decision-makers, for instance, but also on the possibility to collectively, deliberatively, and reflexively re-assess decisions regularly (Castoriadis, 1998). In a way, the Intergovernmental Panel on Climate Change (IPCC) is an example of this new apparatus based on this type of processual legitimacy: in this institutional platform, scientists have to discuss with political actors and members of the civil society what climate is like today and how to “articulate” (Latour, 2004a) ourselves with it; all these participants are representatives of the climate. Furthermore, the legitimacy of this institution’s outcome depends not only on the status of experts (scientific and non-scientific ones) involved in the process but also (and mainly) on the regular re-assessment (every five or six years) of their achievements and of the participants’ presence.

### 3.1.2. Capital in accounting

The definition of capital is also fraught with disagreements from the accounting point of view. As we noted above, there is a gap between the economic and business perspectives concerning the notion of capital. Moreover, the term capital is used in so many ways in accounting that it is difficult, to clearly identify its meaning. For instance, Bellandi (2012) identified eight different usages of the term capital by the Financial Accounting Standards Board (FASB). In fact, the concept of capital is linked to most balance sheet elements: at first, capital is always viewed as connected to equity (this meaning is a common point among researchers and practitioners in accounting). Moreover capital can also encompass liabilities, as in the standard notion of capital structure. Capital also refers to assets: the term ‘capitalising’, for instance, means recording a fixed (or capital) asset. Additionally, recognising new forms of capital as assets is a standard way to resolve debates about their incorporation into the balance sheet, as illustrated by the case of intellectual capital (Brännström & Giuliani, 2009). However, Hicks recalls that “it is not true accountants will insist, that the plant and machinery of a firm are capital; they are not capital, they are assets. Capital, to the accountant, appears on the liabilities side of the balance sheet; plant and machinery appear on the assets side.” (Hicks, 1974).

This distinction between capital and assets is what distinguishes economics from accounting: “in economics capital is an asset [;] money is the most familiar form of capital, but natural resources [...] and human resources [...] are also capital assets” (Rose, 2009) and so capital is placed on the left side of the balance sheet, while in accounting, capital is related to the right side<sup>15</sup> of the balance sheet. In this context, when accounting deals with the notion of capital maintenance, it inherently means maintenance of what is on the right side of the balance sheet and not asset conservation (for a more detailed discussion on this point see (Lee, 1983)). This philosophy can be summed up by this old but still topical adage: “for the purposes of book-keeping treat capital as a liability – treat it just as if it were a debt payable” (Snailum, 1926). We claim that the central paradigm of accounting is ‘maintain to gain’ as opposed to ‘gain to maintain’: profit is achieved if and only if the capital is maintained and its maintenance is not conditional on the identification of potential gains. Consequently, capital cannot be seen as a residue as stated by the International Accounting Standards/International Financial Reporting Standards (IAS/IFRS; IASB [International Accounting Standards Board] 2010) but as a predetermined liability.

Accounting’s conceptualisation of capital is in line with the definition of capital from a social point of view: a resource is recognised as capital from a social perspective and thus, has to be maintained over a given period. If this resource is used by a firm, this preservation obligation should be ‘transferred’ to the organisation: the capital from an extra-organisational point of view would become capital from an organisational perspective. Consequently, maintaining this used capital would be a matter of concern not only for the representatives of the capital but also for the firm. Obviously, this obligation transfer<sup>16</sup> is not self-evident and constitutes a significant issue for (corporate) sustainability. Let us suppose that this transfer occurs for a given capital. From a social point of view, this capital is entrusted in one way or another to the firm that uses it, and the maintenance of this capital, which depends on some subjective and maybe, conflicting points of view, has to be regularly re-assessed by its representatives. The regularity of re-assessments relies on the standard evaluation period of capital durability, as we explained before, and on how the firm uses (or plans to use) the capital (De Saint-Front, De Saint-Front, Schoun, & Veillard, 2012). Let us call this type of maintenance *societal* or *social maintenance*, because it occurs at the interface between the firm and its surroundings (its societal environment) and involves a conception of capital from a social (societal) point of view. From a corporate point of view, the capital maintenance obligation (which we can call symmetrically *corporate*

<sup>15</sup> The right side in a horizontal presentation.

<sup>16</sup> A reverse transfer is possible in theory: the recognition of capital by a large number of firms could involve its recognition as capital from a social point of view. In that case, these firms could be elements of the representatives of this capital.

*maintenance*) implies the implementation of instruments to track its use and guarantee its preservation. Accounting plays a key role at this point. Now, as this situation is normal and normalised as far as financial capital is concerned, we hypothesise that it would be relevant to analyse the instruments accepted in traditional accounting to protect this type of capital relative to its use.

### 3.2. *The conservation of financial capital in traditional capitalist accounting*

We want to reiterate that in traditional accounting, capital is a liability and not a residue. This rule is the first way to preserve capital used by a firm: the objective of conservation is clearly recorded in the accounts. Now, how do we guarantee capital maintenance while the capital is repeatedly and/or continuously used by a firm? From an historical point of view, as far as the financial capital is concerned, the answer to this question is the 'planned depreciation' concept, a concept created by accountants.

As shown by accounting historians (see, notably, (Lemarchand, 1993)), the notion of depreciation was already present at the birth of double-entry accounting in the 14th century,<sup>17</sup> as an instrument of profit calculation within the frame of merchant capitalism. By the 17th century, depreciation was an instrument of industrial capitalism until the last part of the 20th century. Under the reign of financial capitalism, beginning in the 1960–1970s, a systematic attack against this concept was launched under the umbrella of the theory of finance: accounting depreciation was considered to be a bad instrument for measuring profit and needed to be replaced by *financial* depreciation (Beaver, 1989; Brealey & Myers, 2003; Solomon & Laya, 1967). In spite of this attack, backed by the IAS/IFRS, accounting depreciation continues to dominate theory for a large part of assets, notably tangible assets, such as machinery and buildings, as well official standards in practice (Ding, Richard, & Stolowy, 2008). But financial depreciation is gaining more acceptance, as we will show after examining the accounting depreciation concept.

Accounting depreciation is not a simple, unified concept; it has changed throughout the different periods of capitalism. Of course, its main goal is always to acknowledge and record the inevitable death of every component of man-made capital and then to deduct this part from revenues as an expense and to calculate 'true' profit, described by Hicks (1939) as, "a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning"<sup>18</sup> (Hicks, 1939). This formula, which has been applied by most accountants without knowing it well, before Hicks' time,<sup>19</sup> means that if a capitalist wants a sustainable firm, every year, if not every week, he or she must set aside an amount representative of the depreciation of the company's assets to be able to regenerate the company's capital. However, even if the principle is a simple one, its application is difficult and can vary not only for technical reasons but also for political and social reasons, as is the case for any concept of capitalist accounting. According to Ding et al. (2008) and Richard (2005), since the industrial revolution, two main types of accounting depreciation for long-term assets have been employed. The first one, known as early as the 14th century at the time of Tuscan merchants (Lemarchand, 1993), consists of calculating the depreciation of fixed assets on the basis of their market price in the frame of a fictitious liquidation of the firm. This mode of calculation obviously dominated theory and probably practice until the last part of the 19th century. Even if it was accepted by traditional capitalist undertakers, it was rejected by short-sighted capitalists when the big joint-stock companies formed in the 1870s and 1880s because the profits and dividends fluctuated too much with market prices and above all, were condemned to appear only after several years (Richard, 2012b). Thus, another accounting depreciation theory was proposed in the 1880s to satisfy both the capitalist undertakers and the financial capitalists: the HCD<sup>20</sup> system. Under this new system, the initial cost of a long-term asset is distributed over the period of anticipated activity (useful life) of the assets concerned until their presumable death.<sup>21</sup> In practice, the most common solution was to divide the initial purchase price by the number of years concerned. This system was also said to be based on a planned linear depreciation that relied on the hypothesis that the depreciation concerns an equipment that produces an equal quantity of the same production over its life. It can be adjusted in a very flexible way by extraordinary depreciations to account for different physical modifications (but not market prices), such as modifications for the period, level, and rhythm of production, for the environment (temperature, wetness), and for accidents (breakdowns). These ordinary and extraordinary depreciations were deducted yearly from revenue and consequently, reduced profit. Normally, if sales covered the full production cost, including the depreciation, the undertaker should be able to renew the firm's assets in order to maintain the firm's capital. This system was adopted as a compromise between the capitalist undertakers and the capitalists at the end of the 19th century: for the

<sup>17</sup> There is no reason and no place for this article to analyse the place of depreciation in pre-capitalist societies.

<sup>18</sup> We point out that historical cost accounting (HCA) corresponds to the accounting interpretation of the Hicksian profit, defined above, from a corporate point of view. Indeed, "Hicks himself believed that the proper basis of valuation in the financial statements of a firm is historical cost" (Brief, 1982). The introduction of his definition of profit in accounting by Alexander (1950) led to some misunderstandings about the relationship between accounting and economics, and finally a justification of the use of the fair value.

<sup>19</sup> Even at the time of Roman people there is a distinction between 'substantia' (capital) and 'fructus' (profit), with only the latter being consumable so as to preserve its source.

<sup>20</sup> We suppose here that in order to simplify the presentation, there is no inflation, so that the cost to be taken into consideration is the initial cost, that is, the 'historical' cost; if the purchase price (or replacement cost) of the assets were to be higher or lower (independently of a technological change), the HCD system should be replaced by a more complicated system, such as that promoted by Schmidt (1921) – the replacement cost depreciation system.

<sup>21</sup> Theoretically, the final scrap or resale value of the assets should be taken into account, but this is seldom followed in practice.

former, the system assured the maintenance of their capital and distribution of real profits; for the latter, it assured the receipt of regular dividends even in many cases when investments were initiated.

This ‘capitalist pact’ was legalised in most countries at the beginning of the 20th century. A crucial element of this evolution was the entry of a new actor: the tax administration. As soon as the tax administration began taxing profits, the capitalists realised that depreciation deduction as a tax expense was necessary to protect their capital. If we consider that in a majority of countries at the beginning of the 20th century, lawyers decided that it was very difficult, if not impossible, to reimburse capital and to distribute retained earnings, we can conclude that the capitalist system of the 20th century invented, legalised, and institutionalised a system that obliged its members to save and conserve their capital, their financial capital. This remarkable institution, which has even influenced the most liberal agreements like the General Agreement on Tariffs and Trade, is a fundamental aspect of our question.

But financial capital owners have challenged this institution, and thus, a new type of depreciation, the financial depreciation, was proposed during the 1970–1980s by ‘modern’ accountants, such as Beaver (1989), armed with the finance theory promoted by Fisher. According to this theory, capital depreciation is the decrease of the capital’s actuarial value, which is the present value of the flow of services rendered by the capital. This theory has already been applied in the context of the IFRS, notably in matters of intangible assets, such as goodwill (Ding et al., 2008). The consequences of such application on firm management and especially on financial capital conservation are fundamental. With the application of this theory, there is no more yearly planned depreciation: depreciation of fixed assets becomes an ‘impairment’ caused by a decrease in the value of the fixed assets, that is, the present value of future services rendered by the assets. Practically, in the context of expansion or belief of expansion, merely applying these principles at the beginning of investments registers a distributable net present value based on expected data. If this net present value is distributed, any reversal of the economic situation will end in a fictitious dividend distribution and an increase in the risks of failure, such the sub-prime mortgage crisis (Richard, 2014). But finance people want to destroy the principle of historical depreciation to give more liberty to shareholders. As Schaltegger and Figge (2004) eloquently put it, “*contrary to free cash flows the net accounting income concept does not take account of the fact that by obliging the firm to reuse a part of the income for the sake of self-financing it reduces the available part for the shareholder*” (Schaltegger & Figge, 2004). Finance people also want to destroy the concept of legal capital and its fixity (Armour, 2008). Consequently, the difference between capital and income tends to be blurred as these concepts progressively lose their connection to any underlying reality: they only make “*circular references to [...] models which themselves make circular references to accounting signs*” (Macintosh, Shearer, Thornton, & Welker, 2000). Thus, overall, in the field of traditional capitalist management, “*present value maximisation and sustainability can strikingly conflict with each other*” (Neumayer, 1999).

Therefore, traditional capitalist accounting has produced a powerful instrument of financial capital conservation<sup>22</sup>: the concept of planned depreciation or HCD. This concept, although under attack today by finance theoreticians for the sake of impatient shareholders (Chiapello, 2005), remains in use for the majority of assets, notably fixed tangible assets. Furthermore, unlike financial depreciation, HCD enables long-term thinking and, unlike both financial and market depreciations, an (adaptive) anticipation of the repeated uses of financial capital, while fixed in capital assets.

After an analysis of the capital concept as well as the way financial capital is systematically protected in traditional capitalist accounting, we propose an alternative to the TBL accounting framework, the TDL model, which takes into account and preserves human and natural capital.

### 3.3. *The use of historical cost depreciation for natural and human capital: towards the TDL model*

#### 3.3.1. *The axiomatisation of the TDL model*

We first specify the TDL model’s underlying assumptions in Table 1 and then justify them. This axiomatisation can facilitate comparisons and dialogues with other accounting models and norms, notably the IAS/IFRS. This reference to the international standards entails neither an a priori compatibility between the TDL model and these standards nor a predominance of these standards over other accounting systems: we simply need accepted accounting standards to strike up a debate and clarify our model. We also want to avoid one of the TBL model’s core issues: the presence of implicit postulates that lead to its misunderstanding and convey deceptive messages. These assumptions can be divided in two categories. Some of them concern social maintenance (see the end of Section 3.1.2) and how capital from a social point of view is preserved according to representatives’ expectations. The others are directly associated with corporate maintenance and, more precisely, with the design of an accounting system for tracking the use of and for preserving the different types of capital. Strictly speaking, social maintenance is more a political issue than an accounting one, but we consider it is impossible to disconnect an accounting model from societal assumptions: critical accounting is aware of this strong connection, generally implicit and even hidden.

<sup>22</sup> We highlight that the purpose of HCD, although it is recorded on the assets side of the balance sheet, is to preserve only financial capital and not the assets concerned (Lee, 1983).



**Table 1**  
Assumptions of the TDL model.

Social maintenance	SA1 <sup>a</sup>	At least three types of resources are capital from a social point of view: financial, human, and natural.
	SA2	The maintenance of these types of capital requires the most precise ontological investigation possible.
Corporate maintenance	AA1 <sup>b</sup>	A firm's use of human and natural capital implies an obligation for this one to maintain them.
	AA2	The repeated use of these two types of capital implies their systematic degradation.
	AA3	The human and natural capital used by a firm are necessary for achieving its goals, notably its profit.
	AA4	The reporting concerning these two types of capital has to be integrated into the standard financial statements.

<sup>a</sup> Social assumption.<sup>b</sup> Accounting assumption.

3.3.1.1. *Assumptions SA1 and SA2.* The first social assumption (SA1) is the recognition that one way or another, we have to maintain separately, at least, financial, human, and natural resources and that some human and natural resources may have societal and/or non-instrumental values. This premise is, of course, not unanimously accepted, but nevertheless constitutes the basis of the strong sustainability approach (Neumayer, 1999) and of ecological economics (Daly & Farley, 2004). Other types of capital could be taken into account: for instance, on one hand, very strong sustainability asserts (Turner, 1999) that some elements of natural capital have to be preserved independently or, on the other hand, human and social capital should be separated (Costanza et al., 2013). Furthermore, one could argue, for example, that human capital maintenance as a whole does not guarantee the protection of every worker. As this paper is mainly structured as a response to the TBL model, we are inclined to use the same language elements. More substantially, this classification does not prevent other types of resources, if socially recognised as capital, from being protected. Moreover, we believe that this restriction is flexible enough to encompass several different conceptions of sustainability but strict enough to be accepted as a basis for genuine sustainable development. SA1 recognises the protection of human and natural capital (and maybe some of their elements) as a matter of societal concern, but this does not mean that their representatives and in particular, their 'ontological' representatives, are identified and accepted. The representatives' identification and legitimacy problem is a central and tricky one but goes beyond a pure accounting framework<sup>23</sup>: its resolution implies the implementation of political measures like regulations and accounting normalisations and/or the development of a new institutional apparatuses, as we explained in Section 3.1.1.

As least, we can formulate some recommendations, summed up in our second social assumption, SA2. This premise can be interpreted in many ways, but we want to focus on the question 'What are the types of capital that we have to protect?' that is, 'What are their modalities of existence?'<sup>24</sup> (see Subsection 3.1.1 on ontological examination issues). In particular, this point of view urges us to focus on the types of capital at stake and to not consider them as merely outlying or virtual entities. Indeed, protecting a given entity does not necessarily imply focusing on its existence: we can content ourselves with only limited and closed ontologies, as in the case of the neoclassical evaluation of resources.<sup>25</sup> We claim, for instance, that a genuine ontological investigation on a particular socio-environmental capital cannot avoid scientific representativeness. Let us examine two proposals for social maintenance in line with this ontological concern for the considered types of capital. The first one, developed by Hueting (1989) for national accounting and used by Richard's (2012a) CARE micro-accounting model, consists of replacing the demand curve in the neoclassical model with a vertical line that expresses a physical constraint imposed by society on the economy to maintain the availability of a given environmental function. In this approach, the representatives of the type(s) of natural capital are mainly scientists: a firm takes them into account by measuring (always in physical units) the gap between the standard level of sustainability (determined by the scientists) and the actual availability level of the environmental functions of the resources concerned. Hueting's approach was modified at the end of the 1990s by the GREENed National STATistical and Modelling Procedures (GREENSTAMP)<sup>26</sup> (Brouwer, O'Connor, & Radermacher, 1999), another national accounting instrument. From the GREENSTAMP's point of view, "sustainability targets are constructed through a process of social

<sup>23</sup> Even if some virtual solutions have been proposed like an Omniscient Critical Accountant (Thornton, 2013) who would "properly measure and record Canada's assets and liabilities on behalf of the public" and thus, represent a social concern for environmental protection but from a pure apolitical and a-democratic point of view. This type of unrealistic super-representative remains anyway unable to solve ontological issues: even with its presence, assessments of environmental impacts "require a tremendous amount of judgement and pose heady measurement issues" (Thornton, 2013).

This idea to consider a kind of objectified reason for concern for environmental protection is also at the core of the notion of intrinsic value, which would impose a preservation of environmental entities from a moral point of view. This solution remains quite problematic in its justification (Krebs, 1999) and in practice (Gladwin et al., 1995). Furthermore, here again the ontological problem is not really solved (Forsyth, 2003).

<sup>24</sup> For instance, as far as environmental entities are concerned, Katz (1997), referring to (Weston, 1985), sums up this pragmatic and ontological shift in this way: "Weston denies meaning to the question 'Why preserving wilderness?' As a question of practical policy it is too abstract. For the pragmatist the real question is 'Why preserve this wilderness?' – what is it about this particular natural region which interacts with our pluralistic set of interrelating values" (Katz, 1997).

<sup>25</sup> "In the anthropocentric view of [neoclassical economics], it is incorrect to focus on, or even to consider, the physical characteristics of resources if one is interested in examining future resource availability [...] and the only interesting index of scarcity is the price per unit resource [...]" (Hall, 2000). Therefore, from this point of view, resources are immutable entities, with no references to material reality and ecological interactions, conceptualised only through the utility of consumers.

<sup>26</sup> The GREENSTAMP is largely based on Hueting's approach and was developed at the same institution, the Centraal Bureau voor de Statistiek (The Netherlands).

*negotiation and conflict resolution which gives rise to a social demand for sustainability*” (Markandya, Hunt, & Milborrow, 2005). In this instance, the representatives of capital are not only scientists, but also NGOs or local communities. Thus, the GREENSTAMP is in accordance with the ontological pragmatic approach we described at the end of Section 3.1.1: a genuine ontological investigation of capital may require a new comprehension of the articulation between science and society and thus, a dialogue between the different representatives of this capital to regularly determine what this entity is and how to coexist with it. If we generalise the social maintenance approach at the corporate level, this methodology enables a very flexible and pragmatic understanding of capital preservation, because it relies on a deliberation between the representatives concerned and the firm.<sup>27</sup> Therefore, this maintenance concept can integrate modifications and evolutions of the considered types of capital.<sup>28</sup> For instance, let us consider a kind of natural capital that is transformed by use such that its original state cannot be recovered. Its representatives can agree on a new level of maintenance that takes this new capital's reality into account. It does not mean that the representatives will accept every modification of the capital, but rather may consider a periodical revision of what maintaining that capital means (thus, there is no a priori understanding of this concept, but rather a pragmatic one). Furthermore, this methodology not only makes a regular re-assessment of the considered type of capital's ontology possible but also a regular re-evaluation of the representatives who discuss the capital's conservation, as in the case of the IPCC, for example. A deeper exploration of these questions can be found in Latour (2004a). This approach would entail not only developing new institutional apparatuses (as we mentioned in Section 3.1.1) but also implementing 'transitional spaces' of discussion between organisational representatives and non-organisational capital spokespersons (see, for instance, (Palazzo & Scherer, 2007), regarding a “*deliberative concept of CSR that mirrors the discursive link between civil society and the state*”) as well as the recognition of processual legitimacy.

3.3.1.2. *Assumptions AA1, AA2, AA3, and AA4.* The first accounting assumption (AA1) corresponds to the transfer of financial, human, and natural capital from a social point of view into the corporate obligations mentioned at the end of Section 3.1.2: AA1 is the corporate translation of SA1 and can be seen as the cornerstone of an ecological conceptualisation of accounting (Lamberton, 2005). Furthermore, thanks to AA1, we can present another argument for the restriction of capital to financial, human, and natural capital: this classification seems to be a good compromise between corporate management's right to confidentiality and the necessity to communicate with the representatives of these types of capital. However, it is still possible to indicate the representatives of these types of capital and thus, to clarify towards whom the firm is liable.

The second accounting assumption (AA2) is the recognition of the impacts of the recurring use of human and natural capital. AA1 concerns capital maintenance for all types of uses, but a clear distinction must be drawn between occasional and habitual (or repeated) capital uses. Indeed, most socio-environmental degradations stem from this last kind of use. Regular and widespread individual and business uses gradually lead to massive deteriorations of humans and their environment, although accidental or one-shot degradations<sup>29</sup> are often highlighted. For instance, with regards to human capital, occupational risks are divided between injuries and diseases, a distinction that is close to the occasional and repeated categorisation of uses. The OECD defines an occupational injury as “*any personal injury, disease or death resulting from an occupational accident*” and adds that “*an occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity.*”<sup>30</sup> However, “*more than half of all countries still do not collect adequate statistics for occupational diseases. Available data concern mainly injuries and fatalities.*” (International Labour Organization, 2013), and “*for most developed countries, the most common occupational disorders are occupational stress and musculoskeletal disorders*” (Aw, Gardiner, & Harrington, 2007). This refers to typical illness caused by repeated (over-)uses of workers becoming the first human capital degradation sources in firms, so much so that some dedicated western authorities began to notice that occupational illness causes more sickness absence than injuries (Irish Health and Safety Authority 2008). A similar situation exists for natural capital. For instance, more than half of soil degradations stem from recurring uses (notably from overgrazing and agricultural activities (The German Advisory Council on Global Change, 1995). Indeed, the Swedish Society for Nature Conservation (1999) points out that “*repeated use of land for the same crop and the growing number of farms having no animals in the interval since the 1950s have impaired soil structures and reduced the amount of humus in some soils.*” Thus, the significant impact of recurring uses cannot be treated as sporadic or accidental events but have to be recorded in a way that highlights and, eventually, anticipates their systematic characteristic.

The third accounting assumption (AA3) is based on a central stake in sustainability. It stresses that human or natural capital provides a firm with new capacities (resources) that not only contribute to its activities but play a key role in its development and existence. Today, this tendency is increasingly recognised by more research programs and firms. Human

<sup>27</sup> See (Brown, 2009a) or (Brown & Dillard, 2013) for a discussion on the incorporation of a genuine democratic deliberation in accounting.

<sup>28</sup> This procedure allows taking into account the problem of entropy increase. As Georgescu-Roegen (1972) wrote, “*the entropy of the physical universe increases constantly because there is a continuous and irrevocable qualitative degradation of order into chaos. The entropic nature of the economic process, which degrades natural resources and pollutes the environment, constitutes the present danger. The earth is entropically winding down naturally, and economic advance is accelerating the process.*” (Georgescu-Roegen, 1972). Thus, the TDL model can give an answer to this acceleration process but of course, not to the “irrevocable qualitative degradation” of things in our universe.

<sup>29</sup> This difference in treatment relies upon well-known cognitive biases, like the focusing effect, duration neglect, or problems of intention attribution (Cova et al., 2012).

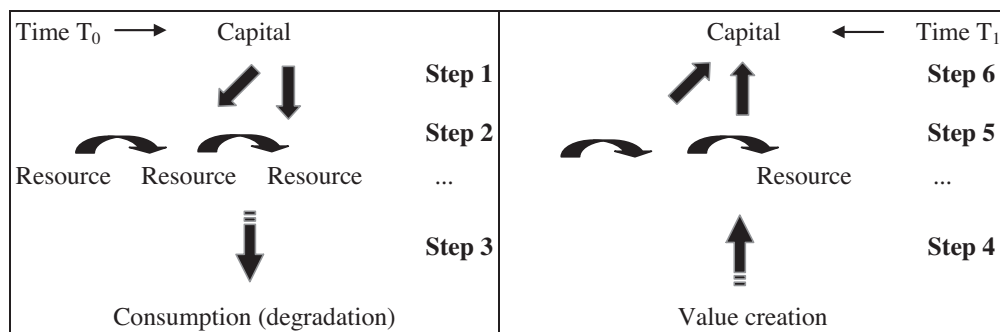
<sup>30</sup> Available online from <http://stats.oecd.org/glossary>.

capital is, therefore, often assumed by managers to be the most important one in their organisation (Fulmer & Ployhart, 2014). Natural capital is similarly considered by accountants and managers as important to business (Association of Chartered Certified Accountants, 2012).

The fourth accounting assumption (AA4) is a controversial one, regularly discussed (Jones, 2010). This debate focuses on two main dichotomies: monetary/non-monetary recording of socio-environmental impacts and, with monetary recording, incorporation or non-incorporation in financial statements of these events. AA4 removes the uncertainty regarding these options from the TDL model, unlike in the TBL model: the TDL model is based on a monetary valuation of socio-environmental degradations that must be integrated in standard financial statements, “in light to the disproportionate attention that monetary values are given by both internal (managers) and external (investors and creditors) users of information” (Sherman, Steingard, & Fitzgibbons, 2002). Moreover, as we stated above, the TDL model relies on the assumption that socio-environmental accounting needs to strike up a debate with today’s accounting norms and is not doomed to stay on the sidelines. This positioning includes an obligation to compare the generally accepted accounting norms with their socio-environmental challengers on common tenets. Under these conditions, we claim that AA4 is a necessary gateway to make these comparisons possible. Lastly, financial statements “should reflect the true values of assets and liabilities [and] should be designed so that all of the company’s stakeholders can utilise the information.” (Gorman, 1999) and thus, should report one and only one profit, which would genuinely reflect all corporate activities. This assumption completely contradicts the TBL framework. In Section 2, we showed that the presence of three different types of profits is a trick which allows a green-like reporting while keeping the usual habits of disclosures and management. We will discuss other issues raised by AA4 in Section 3.4.3.

Based on our analysis of the TBL model in Section 2, we argue that none of the six assumptions are satisfied by this model. The justifications of this assertion are presented in Appendix B. Let us now examine the accounting implications of these postulates by breaking them down according to the different stages of a typical operating cycle as described in Table 2.

Table 2  
Operating cycle.



In Step 1, these implications concern used capital entry recording operations; in Step 2, the eventual production of ‘mixed’ assets; in Step 3, the planned depreciation of repeatedly used assets; in Step 5, ‘de-depreciation’ operations; and in Step 6, used capital exit operations and capital social maintenance re-assessment. Finally, we analyse the consequences of these assumptions for the evaluation of the different types of capital.

### 3.3.2. Accounting implications of the six assumptions

3.3.2.1. *Entry operations.* From an accounting point of view, AA1 and AA4 would involve recognising liabilities linked to human and natural capital in the financial balance sheet at the beginning of their uses: we can simply call these liabilities ‘human capital’ and ‘natural capital’. These types of liabilities are in accordance not only with a classical conceptualisation of capital as we explained before, but also with the IAS/IFRS norms, for which “an essential characteristic of a liability is that the entity has a present obligation” (IASB, 2010). These types of liabilities are regularly examined by environmental accounting. However, it is possible to argue that the capital maintenance concept is related to equity, as explained by the IASB (2010). So, why treat natural and human capital as liabilities and not as equities? We believe the reason rests in recording and distributing profits. An equity account is intended to be regularly enriched by incomes, that is, beyond simple capital conservation; an equity implies a continuous improvement of capital. But are natural and human capital designated to be regularly improved? In the case of natural capital, we believe the answer is ‘no’, all the more that its preservation is not even ensured today. Moreover, it would be a great challenge to determine what a regular improvement of this capital, beyond a ‘simple’ maintenance, would mean. In the case of human capital, the answer is less clear. But even in this case, a problem concerning profit distribution would remain. Indeed, as we pointed out before, AA4 implies that the TDL model relies on achieving one and only one profit, expressed in a monetary unit. If natural and human equity accounts were created, what

would be the process for allocating this income among the different representatives of the equity accounts? We will show that the monetary value of non-financial capital in the TDL model cannot be interpreted as wealth but simply as accumulated maintenance costs. In this way, the value share of each kind of human and natural capital does not correspond to the same share of the income. Now, it is possible to argue that in the human capital case, we could de-correlate profit distribution from the share of value of capital owned by or assigned to the different concerned actors. In other words, instead of using the value of capital as a base for profit allocation, we should use something else, maybe a deliberative and collective base, to distribute this income. This dissociation is a central issue in CSR and sustainability (Harribey, 2011). We do not claim to solve this crucial issue in this study: we only highlight the different stakes behind this question without giving a final answer. Instead, we focus only on the first stage to achieve genuine corporate sustainability: capital conservation. This model can certainly welcome equity accounts for human or natural capital if necessary, so we will now assume that the human and natural capital are liabilities.

The credit of these liabilities (i.e. human and natural capital) implies the debit of an expense or an asset: indeed the AA4 assumption entails the utilisation of the classical credit/debit mechanism. The first proposition is the most classical one and is partially implemented in some accounting norms. For example, the IAS/IFRS recognises some environmental liability recording provisions, like “*the decommissioning costs of an oil installation or a nuclear power station to the extent that the entity is obliged to rectify damage already caused,*” (IAS 37). Nevertheless, environmental expenses are not recognised as they are. Generally speaking, in this first case, the liability corresponding to human and natural capital is an outcome of degradations that occurred during the accounting period and are recorded as expenses. Besides considerable issues concerning the evaluation of these expenses (Gorman, 1999), we find that this procedure is incompatible with AA2 and AA3. Indeed, this method cannot render an account of systematic deteriorations that stretch beyond one accounting period: the firm merely notices that its past activity led to negative socio-environmental effects. In this situation, anticipating future impacts is not seen as central information for stakeholders, including the representatives of the capital. Moreover, these impacts are considered only as costs, that is, losses of profits, and not as consequences of some specific resource use, essential for value creation and firm survival. Under these conditions, AA2 and AA3 impose the adoption of the second proposition, which is also regularly investigated by authors in socio-environmental accounting as discussed in Section 3.4.2: the systematic debit of an asset. In fact, as far as sustainability (and thus, long-term thinking) issues are concerned, capitalisation is a well-adapted procedure because it allows long-term thinking (Williams & Phillips, 1994) as we explained in Section 3.2. Furthermore, it makes anticipations of future capital uses possible (even in the case of one-period uses) and recognises that these uses are a source of value creation.

Therefore, as we explained, the recognition of these new types of assets can be interpreted as capital use, in accordance with the conception of assets in the historical cost approach (Richard, Collette, Bensadon, & Jaudet, 2011) or as resources that can generate future economic benefits, from an economic accounting point of view adopted by the IAS/IFRS (IASB, 2010).<sup>31</sup> We begin by showing that these two points of view do not completely oppose each other: capital use provides the firm with new types of capacities and thus, can be also viewed as resources in our meaning as illustrated in the following example.

**Example 1.** An entrepreneur E creates a firm F with financial capital, a capacity of exchange, CpEx, assessed at 1000 units of money. E wants its CpEx (1000 units) to be preserved and thus, records 1000 on the right side of F’s balance sheet, in the equity account. The utilisation of this capital provides F with CpEx (1000 units), which is not intended to be preserved, given that F will transform and/or consume it. Thus, this usable CpEx is simply a resource (according to our definition) that is recorded in the cash account: in this case, there is no difference in types of capacities between the capital and its use. Then, F buys a machine M for 1000 units, using the financial capital. Thereafter, M provides F with a new type of usable capacity: production capacity, CpPr. Thus, using the financial capital to buy M equates to the appearance of CpPr generated by M. We should note that this CpPr is not designated to be maintained: indeed, not only does F have no obligation to keep its CpPr but can eventually abandon it, depending on its managerial orientations, for instance. Therefore, this CpPr is a resource instantiated in M. Furthermore, M is an asset from our point of view because, as we explained above, the left side of the balance sheet is concerned with resources. M is also an asset from the classical point of view of the historical cost approach, given that M corresponds to the use of a type of capital. Finally, M partially meets the definition of an asset by the IAS/IFRS on the condition that we assimilate the notion of resource used by the IAS/IFRS with ours.

Therefore, M is recorded in a fixed asset account, that is, an account that reports repeated uses.

Besides, AA3 entails that the resources associated with the utilisation of human and natural capital generate future economic benefits and thus, whether it be from an HCA or an economic accounting point of view, the debit of one or several assets

<sup>31</sup> The definition of an asset according to the IAS/IFRS norms also includes the fact that the resource has to be controlled by the entity. We do not want to fully discuss this point in this paper but we note that “*in determining the existence of an asset, the right of ownership is not essential*” (IASB, 2010). Moreover, in 2008, some debates on the IASB and the FASB suggested, in particular, that the notion of control be clarified, to adopt another conceptualisation of an asset and to define it as “*a present economic resource to which the entity has either a right or other access that others do not have*” (FASB, 2008). In a previous discussion, the notion of “*other access that others do not have*” was replaced by the expression “*other privileged access*” (IASB/FASB, 2006). As we see, the notion of “*privileged access*” could be used to extend financial reporting to include human and natural resources not owned. In particular, in the case that we find more interesting in this study, the repeated use of capital, it is possible to claim that the resource generated by this type of use is ‘controlled’ by the firm, in the new meaning of the IASB/FASB. Indeed, our argument is simple: if a firm can use capital in a recurring way, then the firm has a privileged access that enables it to use the capital.



corresponding to the credit of human and natural liabilities is possible. Furthermore, in accordance with AA2, we have to distinguish repeatedly used assets from non-repeatedly used (or occasionally used) ones.

3.3.2.2. *Historical cost depreciation.* As we stated in Section 3.2, we claim that the only way to take capital protection (and thus, AA1) coupled with AA2 into account is to use HCD for recording the consumption of repeatedly used assets. More precisely, this method correlates and anticipates how capital is used with its degradation. For instance, in Example 1, as M is a tangible fixed asset, it is depreciated according to HCD over its use period; thus, the deterioration of the CpPr of M (where CpPr corresponds to financial capital use) is connected to the consumption of the CpEx included in M (financial capital degradation). Therefore, the planned depreciation offers the crucial advantage of focusing on systematic capital deterioration caused by the capital's use.

3.3.2.3. *Production of mixed assets.* During the production process, some 'pure' financial, human, and natural resources may be necessary to create new resources, which can be characterised as 'mixed' assets.

Machine M	1000	600	400	Equity	500
Raw material			100		
Repeated use of human capital (labour)			3000	Human capital	3000

The above is a modified balance sheet of a firm F at the beginning of year N. We suppose that machine M's annual depreciation is 100 and repeated human capital use is 300. The machine M, raw material, and labour are used completely during year N to produce a new machine, machine P, which will be linearly depreciated over five years. Thus, machine P is a mixed asset, generated by financial and human resources. Moreover, its value is equal to

$$500 = \underset{\text{Depreciation of machine M}}{100} + \underset{\text{Consumption of raw material}}{100} + \underset{\text{Depreciation of labour}}{300}$$

Here is the balance sheet just after the production of machine P:

Machine M	1000	700	300	Equity	500
Raw material			0		
Repeated use of human capital (labour)	3000	300	2700	Human capital	3000
Machine P			500		

As the financial resources represent two-fifths of machine P's value and the human resources correspond to three-fifths of its value, machine P's depreciation expense is apportioned, according to these ratios, to the classical financial depreciation expense and the human depreciation expense. Therefore, if no operations occurred during year N + 1, the depreciation expense accounts of year N + 1 are assessed as follows:

Depreciation expenses related to financial capital	140	=	100	+	100	×	2/5
			Depreciation expense of machine M		Total depreciation of machine P		Ratio of financial resources in the value of P
Depreciation expenses related to human capital	360	=	300	+	100	×	3/5
			Depreciation expense of labour		Total depreciation of machine P		Ratio of human resources in the value of P

3.3.2.4. *Exit operations.* We now examine the accounting procedure for the settlement of socio-environmental capital. Suppose that a firm F follows the accounting procedure described in the entry operations and, for example, records this operation in its journal:

Natural capital asset	V
Natural capital	V

Then, F decides to settle its natural capital account using its cash account. The outcome of this operation is that F no longer renders an account of its obligations towards natural capital protection even though it continues to use it since the natural capital asset account (corresponding originally to the natural capital account) remains in the balance sheet. This situation clearly contradicts AA1. Thus, AA1 and AA2 imply that the settlement of a liability corresponding to human or natural capital must result in an outflow of associated assets. This assumption can be compared with the strong sustainability premise SA1: no substitutability between financial, human, and natural capital.

3.3.2.5. *Social maintenance.* During the re-assessment procedure, which occurs at the same time as the social maintenance, the representatives examine the capital to decide whether or not to preserve it, according to its ontological specifications. In the first case (the capital is preserved), the firm F has the right to continue using this capital or to refund it by settling the corresponding asset accounts. As recommended in Section 3.3.1, this maintenance concept can be a pragmatic one. It means that F could be authorised to refund its natural liability even if the original state of the natural capital is not achieved. This situation may occur in the case where the firm precisely followed the maintenance procedures set up collectively at the beginning of the capital use, and despite its goodwill, the capital's state does not satisfy the initial requirements.

In the second case (the capital is not preserved), two main options are possible. The firm agrees with the representatives to continue the capital exploitation, keeping the non-refunded capital account (or a part of it, according to the agreement). This means that the firm keeps a permanent debt in its accounts that it will not be able to settle and that could make access to other types of capital more difficult. Otherwise, the concerned representatives can invalidate F's right to use this capital. More precisely, they do not challenge its right to possess the capital (if it is owned) but instead to record again the resource corresponding to this natural capital use: as we illustrate in Appendix D, use and possession are dissociated in the TDL model. This procedure can eventually lead to lawsuits, an option beyond the scope of accounting and of this study.<sup>32</sup>

3.3.2.6. *De-depreciation.* De-depreciation corresponds to a struggle against capital degradation and thus, against planned depreciation. Therefore, this concept is directly associated with capital maintenance. We illustrate this notion with an example that follows the operating cycle in Table 2.

**Example 2.** A farm F buys a field at the beginning of year N. The field representatives are scientists and a local environmental NGO. These representatives, jointly with the farm, set up a level of field maintenance, which is based, for instance, on several co-determined indicators. They also decide that this field must be examined at the end of year N to ascertain whether or not it is preserved, according to the chosen indicators.

**Step 1:** At the beginning of year N, the field provides F with capacities, particularly fertility, CpFe. In the natural capital account, the farm records an amount C in monetary units, because of AA4. From the farm's perspective, the CpFe is now a resource that it can use. Thus, it reports an asset of the same amount C, called, for instance, 'capacity of fertility'.

Modified balance sheet–Step 1			
		Financial capital	0
RUNC <sup>33</sup> (capacity of fertility)	C	Natural capital (field)	C

**Step 2:** The farm transforms this CpFe into a usable production capacity for wheat, CpPW, because it wants to use this field to only produce this grain. This operation settles the previous asset account and creates a new asset account, called, for instance, 'production of wheat', recorded as a repeatedly used asset. We assume that this field will be used for this production until the end of year N (and not after). The value of this account is still C.

Modified balance sheet – Step 2			
		Financial capital	0
RUNC (production of wheat)	C	Natural capital (field)	C

**Step 3:** This field's recurring use for this production implies a consumption of the initial natural capital's CpFe. As we explained before, we correlate this degradation with CpPW deterioration and thus, have to report systematic depreciation expenses. At the end of year N, all the CpFe embedded in the asset 'production of wheat' will be consumed.

**Step 4:** During year N, this CpFe degradation allows the farm to sell its wheat.

<sup>32</sup> One could argue that this procedure can be assimilated to the ecological communism condemned by Elkington. A reply to this objection can be given by Coase (1960) himself: "we may speak of a person owning land [...] but what the land-owner in fact possesses is the right to carry out a circumscribed list of actions. The rights of a land-owner are not unlimited. [...] This] would be true under any system of law." (as cited in Donaldson and Preston, 1995). In fact, "the concepts of property rights and sustainability are often considered inherently in tension with each other." (Grinlinton 2011). Therefore, without abandoning the concept of property rights, the TDL model, in line with many studies in the area of sustainability, claims that we need a more extensive comprehension of these rights. This discussion also goes beyond the scope of this study, but interested readers can consult Circo (2009).

<sup>33</sup> RUNC stands for 'Repeated Use of Natural Capital'.

**Step 5:** The sales create new CpEx, recorded in the cash account as an amount V.

Modified balance sheet – Step 5					
Cash (capacity of exchange)			V	Financial capital	0
				Income	V-C
RUNC (production of wheat)	C	C	0	Natural capital (field)	C

As the sales generate only financial resources, the net value of the repeatedly used natural capital's account can only decrease, because of the systematic depreciation. Thus, F will never be able to settle the natural capital account; indeed, as we explained in the exit operations, this operation is possible only by settling the corresponding asset account. The TDL model needs to authorise an operation that can increase the use of the RUNC account: we need to implement a de-depreciation, which is unnecessary in the case of financial capital, because the standard creation of values (the revenues) directly replaces the consumed financial resources. This operation is a transformation of a financial resource into a repeatedly used natural resource (or a repeatedly used human resource in the general case) in order to compensate for the systematic depreciation. As such, this transformation in the case of the financial capital is called an investment (conversion of cash into a fixed asset), we can keep this name: de-depreciation is a new kind of investment. In other words, to settle its natural capital account and maintain this capital, F has to invest a part of its financial resources into natural resources. Table 3 sums up the relationship between depreciation and de-depreciation.

One could question if this operation does not contradict SA1 and AA1. Does de-depreciation correspond to a substitutability of capital? The answer is clearly 'no'. This is a strength of the accounting; if a firm records a type of capital in its balance sheet – on the liability side – the hypothesis of this capital's conservation will be at the core of the firm's activity. Therefore, we can substitute resources (capital uses) and, at the same time, maintain the recorded types of capital. Under these conditions, money is considered only as a medium of exchange to maintain this capital, as we will show in the next paragraphs.

Thanks to this de-depreciation operation, we can show how to value natural capital (and human capital in the general case) and its corresponding assets.

3.3.2.7. *Evaluation of capital.* Farm F uses its exchange capacity for field maintenance, in accordance with what was decided with the field representatives. Let us call the total financial costs involved in this procedure the total costs of maintenance (CoM). This operation corresponds to a transformation of a financial resource into a natural resource, fertility capacity, for example. As this resource conversion occurs in order to maintain the natural capital, this operation is a de-depreciation. Therefore, the farm credits its cash account with an amount equal to CoM and debits its CpFe asset account with the same amount.

Modified balance sheet					
Cash (capacity of exchange)			V-CoM	Financial capital	0
				Income	V-C
RUNC (production of wheat)	C	C	0	Natural capital (field)	C
Capacity of fertility			CoM		

**Step 6:** The field representatives determine whether or not the capital is preserved. Let us suppose that, in this example, they validate the maintenance conducted by the farm. Thus, the natural resources, that is, the natural assets CpFe and production of wheat, are used to refund the natural capital.

The net value of the production of wheat account equals 0, because we assume that F totally consumed this resource, while the net value of the capacity of fertility account equals CoM. As the natural capital is refunded by means of this account,

**Table 3**  
Accounting translation of capital degradation and maintenance.

Event		Accounting translation in the TDL model
Systematic capital degradation	➔	Depreciation expense
Capital maintenance		Investment (de-depreciation)

we can claim that  $C = CoM$ . This equality can be generalised to every capital type (including financial capital) and to longer periods. Therefore, we can conclude that

the value of capital is equal to the costs of its maintenance, according to its ontological specifications and during its predetermined period of re-assessment, if all the corresponding resources are consumed.

In fact, we can suppose in most cases that the corresponding resources of a type of capital are consumed, because otherwise, these resources would be completely useless to the firm. In this case, we can hypothesise that it would be unnecessary to record them.

We point out that this type of assessment is close to the 'Environmental Sustainable Costs' approach of Gray and Bebbington (2001). As early as the 1990s, Gray, in accordance with Daly and Cobb, highlighted the importance of maintaining natural capital (Gray, 1990) and of extending the Hicksian income concept to other types of capital (Gray, 1992). Based on these beliefs, he demanded that firms calculate the costs necessary to return the sink to its original state or what additional cost must be borne not to leave the planet worse off (Gray, 1992); these costs would be deducted from profit and expended in the restoration of the biosphere (Gray, 1992). Gray and Bebbington (2001) named this approach the "Environmental Sustainable Costs" approach. In fact, our analysis in this paper showed again the necessity of valuing non-financial capital through this type of 'sustainable cost'. But as these costs are not supposed to be capitalised, Gray's approach does not deal with the depreciation problem.

We also point out that money, except in the case of financial capital, is no longer a measure of the absolute wealth of capital. Indeed, a non-financial capital value is not a value but a cost, where money is used as a proxy: money is commissioned only to build a bridge between financial and other types of capital. In fact, the TDL model involves a disconnection between the three classical money conceptions: "a medium of exchange, a unit of account, and a store of value" (Daly & Farley, 2004). Money as a store of value is at the core of the present value concept (like in IAS 41) and contradicts AA1, AA2, SA1, and SA2: the capital is not intended to be maintained per se, but serves as a capacity to generate future cash flows. The starting point of this type of valuation is neither the capital itself – including its ontological investigation – nor its preservation, but a focus on potential financial capital increases. Under these conditions, human and natural capital degradations, like pollution, are not costs but merely wealth (Spence, Chabrak, & Pucci, 2013). With regards to natural and human capital, according to the TDL model, money begins as nothing more than a medium to maintain exchanges; then, the corresponding amount of the capacity of exchanges necessary to guarantee this maintenance is assessed by using money as unit of account, because of AA4. This means that the value of a type of capital from our point of view cannot be disentangled from maintenance operations, time, and how it is used (and potentially, degraded).

All these subjective parameters tend to question the objectivity of the numbers obtained in this way. A central notion in accounting is the true and fair view of the financial statements principle. In today's conception of this principle, the evaluation type described in this section seems to be sacrilege. But, we believe no more than the mark-to-model conceptualisation of the fair value, which is accepted as a last resort in several IAS/IFRS norms like IAS 41. In fact, the values obtained by this last method are potentially "fictional and imaginary" (Power, 2010), because they may be "biased due to unintentional measurement errors" and to intentional manipulations<sup>34</sup> (Power, 2010). Consequently, proponents of this approach try to reshape the notion of reliability, asserting that "ideas of accounting reliability may change over time, may have relative rather than absolute significance, and may only be grounded in the fiction of an ideal consensus among a community of reasonable measurers," (Power, 2010). In fact, we agree, in part, with this point of view, but not for the same reasons: socio-environmental issues tend to question how accounting conceptualises recorded values in general and their objectivity and fairness in particular. For instance, the inflamed debate about incorporating in accounting non-market values measured through consumer willingness to pay assessments (Magness, 2003) illustrates this problem: on one hand, a genuine description of the socio-economic reality from a neoclassical point of view involves the recognition of these values (Herath, 2005), but on the other hand, their potential subjectivity and measurement uncertainty prevent them from being recorded in accounts. Furthermore, we explain that the complexity of our reality is neither merely objectifiable nor completely subjective, but is a changing entanglement of objective and subjective elements as in the case of biodiversity (see Section 3.1.1). Under these conditions, a genuine integration in accounting of complex socio-environmental issues, which go beyond the restrictive reality of markets, would lead to a more pragmatic approach of numbers (Demeestère, 2005), where at the same time, no absolute truth would exist and pure relativism would be rejected: in accordance with our pragmatic approach of ontological capital investigation and as illustrated by the IPCC process, only institutional and political choices based on processual legitimacy would be able to decide whether or not a number is reliable. The question would no longer be 'Is this

<sup>34</sup> Even Ernst & Young explained in 2005 that "the IASB has placed too much emphasis on its view of what constitutes "relevant" information and has given insufficient consideration to the [...] reliability and understandability. [...] This] has led to accounting standards that require measurements that frequently lack reliability [...]" (Ernst & Young, How fair is fair value? 2005, p. 12).



number an objective one?’ but ‘By which process did we arrive at this number, who participated in establishing it and is it re-debatable in order to clarify its nature?’

We sum up some of the main points developed in the last two subsections in [Appendix C](#), which presents the modified financial statements according to the TDL model. In order to highlight the depreciation expenses, we classified the expenses by nature. Furthermore, the horizontal presentation facilitates the connection between different types of capital and their utilisations. In compliance with the non-substitutability principle of SA1 and AA1, this type of presentation, reinforced by separated boxes, also stresses the fact that the settlement of a human or natural capital must result in an outflow of the associated assets. In [Appendix D](#), we present a detailed example of a use of the TDL model. Having provided the general description of this accounting system, we now discuss some of its important and finer points.

### 3.4. Details about the TDL model

#### 3.4.1. Main consequences of the TDL model

We return to one of our model’s main implications: capital (human and natural) maintenance costs are investments (depreciations), while the degradation due to their uses is recorded as a depreciation. Let us apply these ideas to the repeated use of workers in the context of an employment contract. Some possible representatives of human capital (the workers) in this case are presented in [Appendix A](#). The maintenance costs can be interpreted in three main ways: costs directly paid to workers (to ensure them worthy living conditions), internal expenditures for better working conditions, and internal expenditures for high quality training. The precise definitions of the terms “worthy”, “better” and “high quality” are associated with a workers’ ontological investigation. For example, German co-management (Potthoff 1957) could be seen as an illustration of a collective and deliberative determination of these ontological specifications between the firm and some worker. An essential consequence of the TDL model in this case is that the wage expenses disappear<sup>35</sup>: indeed, the only expense that corresponds to worker use is a depreciation expense, whereas the maintenance costs are still considered investments.

This accounting model also changes the value added and the profit conceptualisation. As maintenance costs are no longer expenses, they are integrated into the value added: thus, maintaining a type of capital does not reduce this value anymore. Then, the profit corresponds to a genuine measure of degradation for all the types of capital used and the firm’s capacity to struggle against them. Indeed, a positive profit means that the concerned firm has the capacity to implement the predetermined maintenance costs of the used capital, while a negative profit suggests that this firm is not sustainable: its activity does not generate enough value to maintain its used capital. Thus, a consequence of the TDL model is determining the sustainable level of income for the firm. In fact, some researchers think that it is impossible to achieve sustainable profit at the micro level, because sustainability is a macro-level issue ([Gray, 1990](#)). But in accordance with [Turner \(1993\)](#), “we should not be deluded into thinking that all global environmental change problems require macro-scale policy interventions.” ([Turner, 1993](#)). More precisely, “individual consumption and production units, operating at the microeconomic level, are the pollution/resource depletion agencies. There is a lot of sense in the maxim “Think global, act local” ([Turner, 1993](#)). One can act at the local level and determine its contribution to (un-)sustainability, even if sustainability determination at that level may be affected by complex factors at the regional, national, or international level. In this way, social maintenance articulation and corporate maintenance in the TDL model make interweaving potential macro-level issues and micro-level actions and sustainable performance measures possible. Indeed, by definition, social maintenance is connected directly to capital maintenance problems at a societal level and may take into account very large-scale issues. The whole development of this point goes beyond the scope of this paper, but a genuine ontological capital investigation (as demanded by SA2) may require a multi-scale examination. However, as we do not hypothesise the existence of unrealistic omniscient or omnipotent actors, this ontological investigation has to be approximated, but regularly re-assessed (with the same reliability problem as capital value, explained in [Section 3.3.2](#)). As a matter of fact, this situation, where macro-level issues have to be articulated with micro-level actions in an approximate but accepted and regularly re-assessed way, is not a completely new one in business management. For example, let us look at depreciation. If it was necessary to require total independence of external factors to calculate a tangible assets depreciation, it would be impossible to record any kind of depreciation due to the fact that tangible asset depreciation depends on worldwide inflation and obsolescence. The presence of several external factors does not prevent accountants from approximating machinery degradation and their replacement costs based on approximate norms of wear and tear established by engineers.

With this example, we also believe a strong link exists between HCD and taking the complexity of our reality into account. Indeed, HCD and the associated HCA not only guarantee capital protection and integrate the systematic degradation of capital as we detailed in [Section 3.2](#), but are also adaptive accounting based on processual and regularly re-assessed thinking where approximations are not an obstacle but a normal and inevitable element of our complex world. Whereas market values accounting focuses only on occasional events without real anticipation or possible adaptations and present values accounting conversely predetermines and freezes decision-making potentially until the end of times ([Gorman, 1999](#)), HCD adapts to the materiality of things and tends to follow this materiality while articulating it with more subjective elements like how these things are used. And, in the case of the TDL model, it is precisely HCD’s adaptation to the necessary capital maintenance re-assessment period that finally makes it possible to regularly estimate (perhaps approximately) non-infinite maintenance costs, without the recourse of a discounting rate.

<sup>35</sup> As we explained in [Section 3.3.2](#) (entry operations), a mechanism of profit sharing could be also implemented in the TDL model.

We conclude with the last consequence of our model, related to the fact that evaluations are based on costs from taking capital maintenance into account. In the TDL framework, values and costs are clearly disentangled without being disconnected (cf. footnotes 12 and 14). Indeed, the central questions about the different values (economic or not) attached to a given type of capital, whether it be the capacity to generate future cash flows or the necessity to preserve it for different reasons (SA1 and SA2 are such values), are not directly recorded in the financial statements (but could be recorded in the annexes if necessary). This does not mean that these questions are not important; they are, but we claim that basically, the first need<sup>36</sup> for an organisation and used capital representatives is to know precisely and track over time the different costs associated with the decisions stemming from these debates. The TDL model highlights a well-known principle: decisions, justified and motivated by different types of values, may consume resources (notably capacities of exchanges) and it is a necessity for an organisation and society to be well aware of these costs over time. By the way, it could be possible to generalise this accounting model to other resource consumption types, like energy consumption simply by modifying AA4 and including another type of unit for capital evaluation.

### 3.4.2. Comparisons of the TDL the model with other accounting frameworks

As far as we know, no other accounting framework satisfies our six assumptions (SA1-2 and AA1-4) and is based specifically on a socio-environmental HCD. An illustrative case and one of the few attempts to modify the TBL model is The System of Integrated Guidelines for Management (SIGMA) Project.<sup>37</sup> The project's goal, which was presented as a "key innovation in the methodology" (The SIGMA Project, 2003), was to calculate a sustainable level of monetary profit reflecting environmental and social performance, to be linked and compared with mainstream financial profit. Although it ends by presenting a TBL framework (see notably (Bent, 2006)), this TBL is very different from Elkington's TBL, notably because it tends to modify the financial profit, offering opposite contrasting conception of profit. As far as methodology is concerned, in environmental accounting matters, the two first steps of the methodology are close to SA1 and SA2 (Howes, 2004; The SIGMA Project, 2003): identification and confirmation of the organisation's most significant environmental impacts and then estimating the sustainable level of impact to determine relevant sustainability targets or sustainability gaps. More precisely, sustainability is considered as a scientific question, not a social one (Bent, 2006). However, there is a significant difference between the TDL model and The SIGMA project's model in the third step when valuing the gaps. Whereas the former retains a constant valuation method – the cost of maintaining capital – the latter values the impacts according to either of two methods: "what it would cost to avoid the impact" or "if avoidance is not possible", "what it would cost to restore any resulting damage (using market based prices where possible)" (The SIGMA Project, 2003). It is clear that there is a possible overlap of the TDL and the SIGMA methods if, in the latter, the firm's choice favours avoiding the impacts: all will depend on the interpretation of the phrase "if avoidance is not possible". If this second valuation method is chosen, the SIGMA Project ends up in a neoclassical internalisation of externalities on the basis of market prices or similar values that contradict, at least, SA2. Another difference between these two approaches is the absence of the balance sheet in the SIGMA method, which violates AA4 (and partially, AA1), because no natural and human capital recording occurs: hence it is impossible to use a true depreciation concept<sup>38</sup> and the silence about the consequences to governance matters of capital recording on the liabilities side. Another important difference is in the silence about the possibility of compensating for the different lines of the TBL model. The SIGMA Project cannot be clearly classified on the side of strong natural and human capital conservation: this concept is symptomatically not used in the texts we have referred to and thus, does not satisfy SA1 or AA1.

If we limit our comparison to accounting models that recognise some human and environmental assets, we find that, as we mentioned in Section 3.2, these models assess such assets through their fair value. For example, even if the IAS/IFRS norms recommend capitalising and depreciating some environmental costs during their useful life, like "the initial estimate of the costs of dismantling and removing the item [of property] and restoring the site on which it is located" (IAS 16), they also introduce new assessment types based on fair values, such as for biological assets (IAS 41). Some illustrative examples of human and natural capital capitalisation not completely based on fair value can be found in the literature – Dobija (1998) for human capital, Rubenstein (1992) for natural capital, and Magness (1997) for a firm's experience (an oil and gas company in western Canada) concerning a part of its natural capital. The balance sheet structure in (Dobija, 1998) is as follows (Table 4):

**Table 4**  
Balance sheet in Dobija (1998).

Physical, intangible, and financial assets	Financed by owner's capital
Intangible human assets (costs not expired for hiring, training, etc.)	
Human assets	Human capital
Social assets	Social funds

<sup>36</sup> Simultaneously with these – perhaps informal and extra-organisational – debates on values.

<sup>37</sup> This project was launched in 1999 with the support of the UK Department of Trade and Industry and led by three associations: the British Standards Institution, Forum for the Future (a non-profit think tank), and Accountability, with funding from the Chartered Institute of Management Accountants. It was notably influenced by Ekins and Howes.

<sup>38</sup> Howes (2004), relying on an earlier work (Howes, 2000), insists that firms "need to begin to account for the depreciation of natural capital in the same way that accounting rules and standards require them to account for the depreciation of manufactured capital" but does not refer to any balance sheet and does not use the term depreciation when describing the pro forma environmental financial statements.

Notice that the different types of capital are clearly separated as in the TDL model: thus, this model seems to satisfy AA1. The value  $V$  of human assets rests upon the historical cost methodology.  $V$  equals  $(K + E)(1 + Q(t)) (t - \text{years of experience})$ , where  $K$  is the capitalised cost of living,  $E$  is the capitalised cost of professional education, and  $Q(t)$  is the value gained through experience. However, this model does not incorporate planned depreciation and thus, does not fulfil AA2 and AA1.

Rubenstein (1992) attempted to “green” Hooker Chemical’s accounting, then Occidental Petroleum (after its acquisition), which was responsible for the Love Canal catastrophe. Here, the valuation of the natural asset account is “based on the higher of potential clean-up costs or the estimated discounted cash value of the future productive value of the asset, over its natural regenerative life cycle”, (Rubenstein, 1992) less accumulated depreciation (Gorman, 1999). This model is a cross between the historical cost methodology and the fair value methodology; moreover, although it incorporates natural depletion in the corporate accounts, which is a significant improvement over other models, it does not consider systematic natural asset account depreciation.

In the final example, “environmental restoration cost estimates are included in the conservation-reclamation plan required by the provincial government when applying for the multi-year production permit. The costs, based on engineering estimates, are projected over the life of the project. [...] The] company bases its estimates on the costs to restore the environment to its natural state. Total projected costs are amortised over the estimated number of barrels of oil. Environmental costs are then charged against income each year, based upon the number of barrels produced, with a corresponding long-term liability recognised in the balance sheet.” (Magness, 1997). This case seems closest to the TDL model. Unfortunately, Magness (1997) does not provide sufficient information for us to determine whether or not this procedure is applied to human capital or if SA2 is satisfied.

### 3.4.3. General comments on the structure of the TDL model and its implementation

We begin by reemphasizing the fact that maintenance from a societal point of view – the social maintenance – relies mainly on political choices of our society concerning sustainability. Although accounting has to be connected to these choices, it cannot replace them. This means that accounting alone cannot ‘save our world’ but is nevertheless a very powerful means of rationalising human activity and plays an important role in the construction (Chiapello, 2012) and performance (Ezzamel, 2009) of politico-economic systems, making it essential in society’s institutionalisation of a sustainable economy (broadly speaking). Under these conditions, the TDL model can be interpreted in several ways. In one extreme, it would only be a theoretical construct, which would prove only that it is possible to axiomatically build an accounting system that satisfies strong socio-environmental postulates. As our society and the accounting community could not really evolve towards these assumptions, the TDL model would be doomed to remain a hypothetical ‘jeu d’esprit’. In another extreme, in a completely ecological society where, for instance, deliberative institutional apparatuses are implemented, the TDL framework would be an example (but maybe not one of the more highly developed) of a potentially normalisable standard accounting system. More pragmatically and concretely, we find this model to be a contribution and maybe a kind of foothold to strong socio-environmental accounting systems<sup>39</sup> that cannot be fully implemented on its own anyway without *co-evolution* with some other societal institutions, as well as corporate governance (Kaufman & Englander, 2005; Richard, 2012a), and corporate ontological change (Banerjee, 2007). Its role is not to be strictly applied, but rather to strike up a debate with other accounting types, to highlight central stakes and issues, starting with the depreciation concept and the strong sustainability and ontological capital investigations, while proposing solutions to address such stakes and issues in a really sustainable way, and finally, to facilitate the evolution of business and the current institutional apparatuses. Furthermore, as our model tends to advocate a regularly re-assessed conception of our reality, this framework could also follow the same path. Whatever this model might be, it offers the possibility of another accounting imaginary which could be a link towards a sustainable economy.

A limitation of this approach is that it is impossible to change the accounting imaginary if we assume AA4 and keep the same capitalist and neoclassical instruments in accounting, like monetary units, the concept of capital and the depreciation or debit/credit principle. As explained about the assertion AA4 in Section 3.3.1, we do not want to completely break off all contact with standard accounting practices and debates. Discussing them also means accepting some concessions. Besides, this accounting system is based on the idea that it is possible to take some capitalist accounting weapons (and, in particular, the capital and depreciation concept), turn them into financial capitalism, and develop a kind of anti-capitalist capitalism. More substantially, if we focus on the debit/credit principle problem, we agree that this mechanism might raise some fundamental issues for the implementation of socio-environmental accounting (Deegan, 2013), in particular, because some parts (debit or credit) of the concerned operations may be unknown or non-assessable and because this principle conveys the Modern dichotomy between Subjects (towards whom the organisation is liable) and Objects (that are used), which is potentially incompatible with genuine sustainability (Latour, 1993). Using the TDL model, we tried to explain how to (imperfectly) tackle the problems of identification of liabilities and their assessments with the notion of representatives and ontological capital investigation. Under these conditions, in particular, with the acceptance of SA1, SA2, and AA1, and as our accounting framework is based only on real costs and not on fictive values, the credit/debit mechanism keeps a real meaning: in this model, we record anticipated (but real) resource consumption coupled with a real obligation to capital preservation.

<sup>39</sup> Recently, a research group, along with a consulting firm and several other firms, began working on the TDL model in order to compile these companies’ experiences in this model’s implementation.

Another limitation in the (complete or partial) implementation of this model is its cost, not only direct costs from executing it at a micro level, but especially the potentially high and suboptimal (from a neoclassical point of view) maintenance costs and those<sup>40</sup> due to the ontological investigations (and in particular, the development of dedicated institutions and representative payment) that it would entail. The importance of maintenance costs at the micro and even macro levels remains to be seen: while some studies have shown the significant burden of these costs on the national income (Huetting, Bosch, & De Boer, 1992),<sup>41</sup> others have shown only a modest financial drain (Bebbington, Gray, Hibbitt, & Kirk, 2001; and more recently Altukhova, 2013) at the micro-level for an agricultural firm). Besides, the existence of pure non-market values (Scott et al., 1998), which are potentially huge (Magness, 2003), like the existence value, severely questions the capacity of markets to correctly assess maintenance costs of socio-environmental entities and points out that even internalising all externalities could lead to significant costs. In fact, existing or created market efficiency for socio-environmental issues sweeps a lot of hidden costs under the rug. Moreover, estimation techniques for these non-market values (like the contingent valuation method) are quite expensive and their normalisation and systemisation imply the development of particular institutional apparatuses. Thus, we note that genuinely taking the neoclassical framework into consideration seems to require a massive business (Magness, 2003) and societal adaptation, without really being able to implement a sustainable economy as shown by Pearce (1976) and Godard (2011). Consequently, instead of desperately looking for consumers' willingness to pay, we suggest that it would be more constructive to focus on our world and its understanding, starting with the fact that humans are not disconnected idealistic atoms but relational and political animals. An ontological blindness on our reality cannot lead to anything other than inefficient public and private policies as well as potential unexpected 'reprisals' of the thus forgotten parts of our reality (Latour, 2004a), creating much higher social costs in the end. Finally, we argue that it is time to replace the erroneous economic performance calculation that leads to the planet's destruction (Gray, 1994). To conclude, we point out that history had some partially similar debates when the depreciation of the man-made capital concept was introduced: a significant number of capitalists were opposed to the systematic depreciation expense registration resulting in a profit reduction. It has been necessary for the legislators at the national and international levels (see notably the World Trade Organization's anti-dumping rules) to take specific measures to oblige all capitalists to take account of financial capital depreciation. However, in our case the question of systematic natural and human capital depreciation is a much more important one: it is a question of mankind's survival. If society acknowledges this need, it should not hesitate to impose a challenging environmental accounting on businesses, even if it means a decrease of (windfall) business profits.

#### 4. Conclusion

In this study, we analysed the TBL model and its limitations and then suggested a new accounting framework that enables genuine integrated reporting. Deconstructing the TBL approach allowed us to uncover its serious limitations that lead to its ineffectiveness in the absence of win-win strategies. Despite seemingly promoting sustainability, the TBL model proves to be merely an extension of the business-as-usual accounting model, which eventually favours and highlights situations with no real tensions between the preservation of different types of capital. Moreover, its success tends to hinder the development of other socio-environmental accounting and reporting concepts. Furthermore, as deconstruction and critique are not enough (Latour, 2004b), we proposed an alternative, the TDL model, designed to do the job normally assigned to the TBL. To avoid the confusion and misunderstanding conveyed by the TBL model about its assumptions and to enable comparison with other accounting models, we developed the TDL model analytically and logically from a set of explicit axioms (SA1–2 and AA1–4). In other words, we detailed the construction of the TDL model in such a way that accepting these six postulates implies the development of an accounting model similar to the TDL framework. In order to guarantee real capital protection, we analysed this concept and proposed a comprehensive definition of capital and a resource. We argued that two capital maintenance types have to be implemented – social and corporate maintenance. SA1 and SA2 focus on social maintenance; they express a necessity to protect at least three types of capital (financial, human, and natural) and to invert the current perspective on capital protection: starting directly from the capital elements themselves and carefully investigating their ontologies (maybe changing) in order to preserve them, rather than remaining contented with limited, closed, and predetermined ontologies. We introduced some key ideas to tackle these two assumptions, like integrating scientific representatives in capital maintenance, implementing processual and regularly re-assessed thinking in order to adapt to the complexity of our (locally approximable but globally uncertain) reality, and developing new or re-shaping existing institutional apparatuses and transitional spaces between firms and society, where a dialogue between capital representatives and organisations are possible. To that end, we developed AA1 to AA4 to deal with corporate capital maintenance. Instead of merely observing human and natural capital gains and losses – eventually expressed in controversial units – as in the case of the TBL model, AA1 to AA4 invert this logic by using the one of the traditional capitalist accounting: maintaining capital to gain (only one type of) profit. Furthermore, we showed that these axioms, in particular, that on capital protection (AA1) and the recognition of their systematic degradation when repeatedly used (AA2), imply the use of another central instrument of traditional capitalist accounting, which protects and enhances financial capital: HCA

<sup>40</sup> Perhaps including not only economic, but also cognitive or political costs.

<sup>41</sup> Huetting et al. (1992) are aware that if the burden is too large, it could be necessary to spread the corresponding expenditures over a number of years.



and planned depreciation. We also claimed that this depreciation type is well adapted to the aforementioned processual thinking. Finally, we analysed the TDL model itself: we pointed out some of its main consequences, like its ability to define sustainable profit, highlighted the originality of its construction, in particular, its placement of HCD at its core, and examined its structure and implementation, like its peculiar articulation with society.

In conclusion, the TDL model is a contribution, and maybe a kind of footboard, to strong socio-environmental accounting systems as well as genuine integrated reporting. Above all, it offers the possibility of another accounting imaginary: indeed, “social change requires more than activist campaigning and street movements. [. . . It] requires coherent ideological articulation.” (Cooper, 2005).

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### Appendix A.

#### Examples of possible representatives according to type of capital.

Type of capital	Possible representatives
Natural capital	Scientists, NGOs, and public organisations
Human capital	Concerned humans, medical staff, trade unions, NGOs, etc.
Financial capital	Shareholders, creditors, NGOs of owners, etc.

### Appendix B

Assumptions of the TDL model	Justifications for the assumptions' non-satisfaction by the TBL model
SA1	The TBL model is based on a weak sustainability conception of economy.
SA2	The eco-efficiency assumption behind the TBL model tends to focus not on a genuine ontological investigation of human and natural capital but on an (over-)simplification of these types of capital: the central stake is to increase efficiency and not to improve understanding of our common world.
AA1	Even if the TBL model claims that it satisfies AA1, as we showed in Section 2, when no win-win strategies exist, only the financial has to be maintained in the end.
AA2	The TBL model does not include the concept of systematic depreciation.
AA3	This assumption may be more or less satisfied in some applications of the TBL framework but, in general, as we showed in Section 2, the income, for instance, does not depend on human and natural capital recognition in the framework.
AA4	As we argued in Subsection 3.3.1, the TBL model is generally based on non-monetary units; furthermore, it does not use profit and loss statements.

**Appendix C.**

**Modified financial statements according to the TDL model**

**Balance Sheet**

Fixed assets	$F_0 - D_0$	Equity	E	Financial capital	Standard Balance Sheet	Balance Sheet of the TDL model
Other assets	$A_0 - \Delta$	Income	$R - Ex - D_T$			
		Liabilities	L			
Repeated uses of human capital	$F_1 - D_1 + \Delta_1$	Human capital <sup>42</sup>	H			
Occasional uses of human capital	$A_1$					
Repeated uses of natural capital	$F_2 - D_2 + \Delta_2$	Natural capital	N			
Occasional uses of natural capital	$A_2$					
Long-term mixed assets	$F_3 - D - D' - D''$					
Current mixed assets	$A_3$					

**Profit and Loss (P &L) Statement**

<b>Triple Depreciation Line</b>	Expenses (except depreciation expenses)	E	Revenues	R	Standard P&L Statement	P&L Statement of the TDL model
	Depreciation expenses of the asset(s) related to financial capital	$D_0 + D$				
	Depreciation expenses of the asset(s) related to human capital	$D_1 + D'$				
	Depreciation expenses of the asset(s) related to natural capital	$D_2 + D''$				

$F_i$  ( $i = 0, 1, 2, \text{ or } 3$ ) refers to the historical cost of the corresponding assets, while  $D_i$  ( $i = 0, 1, 2, \text{ or } 3$ ),  $D$ ,  $D'$ , and  $D''$  represent depreciations.

$D_T$  stands for the total depreciation and is equal to  $D_0 + D_1 + D_2 + D + D' + D''$ .

$\Delta = \Delta_1 + \Delta_2$ , where  $\Delta_1$  and  $\Delta_2$  correspond to de-depreciations. Moreover, the balance sheet is balanced: the total value of the three accounting categories on the right side of the balance sheet is equal to the total value of the four accounting categories on the left side.

**Appendix D**

This example is based on [Example 2](#). A farm F buys a field at the beginning of year N. The field representatives are scientists and a local environmental protection NGO. These representatives, jointly with the farm, set up a level of field maintenance, which is based, for instance, on several co-determined indicators. They also decide that this field must be examined at the end of year N+2 to ascertain whether or not it is preserved, according to the chosen indicators. The procedures and the corresponding maintenance costs, which constitute the value of the natural capital, are determined by the field representatives, according to the utilisation type needed by farm F (here, production of wheat). Jointly with F, they develop the following cost schedule:

- Year 1: 100 units of money
- Year 2: 200 units of money
- Year 3: 300 units of money

We highlight again that these costs depend on the farm’s type of natural capital use. In these conditions, the natural capital value is assessed as  $100 + 200 + 300 = 600$  units. As this field will be used only for wheat production during these three years, the farm records a linear natural depreciation over the course of this period of the amount  $600/3 = 200$ . As we consider a very simple example, the duration of this particular natural capital use (wheat production) is the same as the pre-determined period at the end of which the natural capital must be examined: in general, the linear depreciation relies only on the period of use and is not directly correlated to the period predetermined by the spokespersons. This depreciation is recorded at the end of each year and, for this example, corresponds to operation (3) of the depreciation account in the table below.

As we explained in Example 2, the cash will be transformed into natural resources. In order to simplify the recording, the credit of the cash account, at the amount of the maintenance costs actually paid by the farm, will correspond directly to the debit of the accumulated depreciation of the production of wheat account. Thus, these maintenance costs *de-depreciate* the asset ‘production of wheat’. In this example, we assume that instead of spending the 100 units initially planned, F decides, according to the actual state of the field, to pay only 50 units. The recording (2) in the table below corresponds to this operation. In this way, the maintenance costs concretely spent are no longer mere expenses but investment types; through this de-depreciation, capital preservation is an investment. The only expense corresponding to this maintenance is now the depreciation expense, which symbolises the degradation of the concerned capital.

TDL statements of the example in Appendix D

Balance Sheet – 01/01/N				Balance Sheet – 31/12/N			
Field	1000	Equity	1000	Field	1000	Equity	1000
				Cash	450	Income	300
PW <sup>43</sup>	600	Natural capital	600	PW	600   150   450	Natural capital	600
Profit and Loss Statement – Year N							
		Natural depreciation	200 (3)	Sales			500 (1)

Accumulated depreciation of the production of wheat account – Year N		Cash account – Year N	
(2) 50	200 (3)	(1) 500	50 (2)

**References**

Alexander, S. S. (1950). *Income measurement in a dynamic economy*. In American Institute of Accountants (Ed.), *Five monographs on business income* (pp. 1–95).  
 Allenby, B. (2005). *The Pluralistic Ontologies of Biodiversity*. *GreenBiz.com*. Retrieved from <http://www.greenbiz.com/blog/2005/03/31/pluralistic-ontologies-biodiversity>  
 Altukhova, Y. (2013). *Comptabilité agricole et développement durable: Etude comparative de la Russie et de la France*. PhD Thesis under the direction of Prof. J. Richard. Paris Dauphine.  
 Armour, J. (2008). *Legal capital: An outdated concept?* In H. Eidenmüller & W. Schön (Eds.), *The law and economics of creditor protection: A transatlantic perspective* (pp. 3–26). T.M.C. Asser Press.  
 Audretsch, D. B. (2007). *The entrepreneurial society*. New York: Oxford University Press.  
 Aw, T.-C., Gardiner, K., & Harrington, J. M. (2007). *Occupational health: Pocket consultant* (5th ed.). Oxford: Blackwell Publishing.  
 Banerjee, S. B. (2007). *Corporate social responsibility: The good, the bad and the ugly*. Cheltenham: Edward Elgar Publishing.  
 Bastianoni, S., Niccolucci, V., Pulselli, R. M., & Marchettini, N. (2012). Indicator and indicandum: Sustainable way vs prevailing conditions in the ecological footprint. *Ecological Indicators*, 16, 47–50.  
 Beaver, W. (1989). *Financial reporting: An accounting revolution*. Englewood Cliffs, NJ: Prentice Hall International.  
 Bebbington, J., Gray, R., Hibbitt, C., & Kirk, E. (2001). *Full cost accounting: An agenda for action*. London: ACCA Research Report No 73.  
 Bellandi, F. (2012). *Dual reporting for equity and other comprehensive income under IFRSs and U.S. GAAP*. John Wiley & Sons.  
 Bent, D. (2006). *Towards a monetised Triple Bottom Line for an alcohol producer*. Using stakeholder dialogue to negotiate a licence to operate by constructing an account of social performance. In S. Schaltegger, M. Bennett, & R. Burritt (Eds.), *Sustainability accounting and reporting* (pp. 61–82). Springer.  
 Brännström, D., & Giuliani, M. (2009). Intellectual capital and IFRS3: A new disclosure opportunity. *Electronic Journal of Knowledge Management*, 7, 21–30.  
 Brealey, R. A., & Myers, S. C. (2003). *Principles of corporate finance* (7th ed.). New York: McGraw-Hill/Irwin.  
 Brief, R. P. (1982). Hicks on accounting. *Accounting Historians Journal*, 9, 91–101.  
 Brouwer, R., O’Connor, M., & Radermacher, W. (1999). GREENed National STATistical and Modelling Procedures: The GREENSTAMP approach to the calculation of environmentally adjusted national income figures. *International Journal of Sustainable Development*, 2, 7–31.  
 Brown, J. (2009a). Democracy, sustainability and dialogic accounting technologies: Taking pluralism seriously. *Critical Perspectives on Accounting*, 20, 313–342.

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- Brown, M. B. (2009b). *Science in democracy: Expertise, institutions, and representation*. Cambridge, MA: The MIT Press.
- Brown, J., & Dillard, J. (2013). Critical accounting and communicative action: On the limits of consensual deliberation. *Critical Perspectives on Accounting*, 24, 176–190.
- Castoriadis, C. (1998). *The imaginary institution of society*. The MIT Press.
- Chapin, F. S., III, Folke, C., & Kofinas, G. P. (2009). A framework for understanding change. In F. S., Chapin, III, C. Folke, & G. P. Kofinas (Eds.), *Principles of ecosystem stewardship: Resilience-based natural resource management in a changing world* (pp. 3–28). Springer Science & Business Media.
- Chiapello, E. (2005). Les normes comptables comme institution du capitalisme. Une analyse du passage aux normes IFRS en Europe à partir de 2005. *Sociologie du Travail*, 47, 362–382.
- Chiapello, E. (2012). La construction comptable de l'économie. In M. Nikitin & C. Richard (Eds.), *Comptabilité, société, politique: Mélanges en l'honneur du Professeur Bernard Colasse* (pp. 127–140). Economica.
- Circo, C. J. (2009). Does sustainability require a new theory of property rights? *University of Kansas Law Review*, 58, 1–51.
- Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics*, 3, 1–44.
- Cooper, C. (2005). Accounting for the public interest: Public ineffectuals or public intellectuals? *Accounting Auditing & Accountability Journal*, 18, 592–607.
- Costanza, R., Alperovitz, G., Daly, H. E., Farley, J., Franco, C., Jackson, T., et al. (2013). *Building a sustainable and desirable economy-in-society-in-nature*. Canberra: ANUE Press.
- Cova, F., Dutant, J., Machery, E., Knobe, J., Nichols, S., & Nahmias, E. (2012). *La philosophie expérimentale*. Paris: Vuibert.
- Daly, H. E. (1990). Sustainable growth: A bad oxymoron\*. *Journal of Environmental Science & Health Part C*, 8, 401–407.
- Daly, H. E. (2006). Sustainable development – Definitions, principles, policies. In M. Keiner (Ed.), *The future of sustainability* (pp. 39–53). Dordrecht: Springer.
- Daly, H. E., & Farley, J. (2004). *Ecological economics: Principles and applications*. Island Press.
- De Saint-Front, J., De Saint-Front, P., Schoun, G., & Veillard, M. (2012). *Manifeste pour une comptabilité universelle*. Paris: L'Harmattan.
- Deegan, C. (2013). The accountant will have a central role in saving the planet ... really? A reflection on green accounting and green eyeshades twenty years later. *Critical Perspectives on Accounting*, 24, 448–458.
- Demeestère, R. (2005). Pour une vue pragmatique de la comptabilité. *Rev. Fr. Gest.*, 31, 103–114.
- Ding, Y., Richard, J., & Stolowy, H. (2008). Towards an understanding of the phases of goodwill accounting in four Western capitalist countries: From stakeholder model to shareholder model. *Accounting Organizations and Society*, 33, 718–755.
- Dobija, M. (1998). How to place human resources into the balance sheet? *Journal of Human Resource Costing & Accounting*, 3, 83–92.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20, 65–91.
- Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment*, 11, 130–141.
- Elkington, J. (1997). *Cannibals with forks: The Triple Bottom Line of 21st century business*. Oxford: Capstone Publishing.
- Ezzamel, M. (2009). Order and accounting as a performative ritual: Evidence from ancient Egypt. *Accounting Organizations and Society*, 34, 348–380.
- FASB (2008). *IASB Board Meeting 13–17 October 2008 and Joint Meeting of IASB and FASB 20–21 October 2008*. Retrieved from [http://www.iasplus.com/en/meeting-notes/iasb/2008/agenda\\_0810](http://www.iasplus.com/en/meeting-notes/iasb/2008/agenda_0810)
- Faucheux, S., Froger, G., & Noel, J.-F. (1995). What forms of rationality for sustainable development? *Journal of Socio-Economics*, 24, 169–209.
- Fisher, I. (1919). *The nature of capital and income*. New York: Macmillan and Co.
- Forsyth, T. (2003). *Critical political ecology: The politics of environmental science*. New York: Routledge.
- Fulmer, I. S., & Ployhart, R. E. (2014). "Our most important asset" A multidisciplinary/multilevel review of human capital valuation for research and practice. *Journal of Management*, 40, 161–192.
- Funtowicz, S. O., & Ravetz, J. R. (1991). A new scientific methodology for global environmental issues. In R. Costanza (Ed.), *Ecological economics: The science and management of sustainability* (pp. 137–152). New York: Columbia University Press.
- Georgescu-Roegen, N. (1972). *The entropy law and the economic process*. Cambridge, MA: Harvard University Press.
- Georgescu-Roegen, N. (1977). Inequality limits to growth from a biocentric viewpoint. *Review of Social Economy*, 35, 361–375.
- Gladwin, T. N., Kennelly, J. J., & Krause, T.-S. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review*, 20, 874–907.
- Godard, O. (2011). La discipline économique face à la crise de l'environnement. In J.-P. Touffut (Ed.), *Changement de climat, changement d'économie?* Albin Michel.
- Gorman, R. F. (1999). Valuation and reporting. In O. L. Loucks, O. H. Ereksun, J. W. Bol, R. F. Gorman, P. C. Johnson, & T. C. Krehbiel (Eds.), *Sustainability perspectives for resources and business* (pp. 105–138). Boca Raton, FL: Lewis Publishers.
- Gray, R. (1990). *The greening of accountancy: The profession after Pearce*. London: Certified Accountants Publications.
- Gray, R. (1992). Accounting and environmentalism: An exploration of the challenge of gently accounting for accountability, transparency and sustainability. *Accounting Organizations and Society*, 17, 399–425.
- Gray, R. (1994). Corporate reporting for sustainable development: Accounting for sustainability in 2000AD. *Environmental Values*, 3, 17–45.
- Gray, R., & Bebbington, J. (2001). *Accounting for the environment* (2nd ed.). London: SAGE.
- Gray, R., & Milne, M. (2004). Towards reporting on the Triple Bottom Line: Mirages, methods and myths. In A. Henriques & J. Richardson (Eds.), *The Triple Bottom Line: Does it all add up?* (pp. 70–80). London: Earthscan.
- Hall, C. A. S. (2000). The Theories and Myths that have guided development. In C. A. S. Hall, P. Van Laake, C. L. Perez, & G. Leclerc (Eds.), *Quantifying sustainable development: The future of tropical economies* (Vol. 1, pp. 45–89). Academic Press.
- Harribey, L. E. (2011). Strategic value of corporate citizenship. In S. Idowu & C. Louche (Eds.), *Theory and practice of corporate social responsibility* (pp. 23–39). Springer-Verlag Berlin Heidelberg.
- Herath, G. (2005). Sustainable development and environmental accounting: The challenge to the economics and accounting profession. *International Journal of Social Economics*, 32, 1035–1050.
- Herring, H., & Sorrell, S. (2009). *Energy efficiency and sustainable consumption: The rebound effect*. Basingstoke: Palgrave Macmillan.
- Hicks, J. R. (1939). *Value and capital: An inquiry into some fundamental principles of economic theory*. Oxford: Clarendon Press.
- Hicks, J. R. (1974). Capital controversies: Ancient and modern. *American Economic Review*, 64, 307–316.
- Holliday, C. O., Schmidheiny, S., & Watts, P. (2002). *Walking the talk: The business case for sustainable development*. San Francisco: Berrett-Koehler Publishers.
- Howes, R. (2000). Corporate environmental accounting: Accounting for environmentally sustainable profits. In S. Simon & J. Proops (Eds.), *Greening the accounts* (pp. 223–245). London: Edward Elgar Publishing.
- Howes, R. (2004). Environmental cost accounting: Coming of age? Tracking organizational performance towards environmental sustainability. In A. Henriques & J. Richardson (Eds.), *The Triple Bottom Line: Does it all add up?* (pp. 99–112). London: Earthscan.
- Huetting, R. (1989). Correcting national income for environmental losses: Toward a practical solution. In Y. J. Ahmad, S. E. Serafy, E. Lutz, & UNEP (Eds.), *Environmental accounting for sustainable development* (pp. 32–39). Washington, DC: World Bank.
- Huetting, R., Bosch, P., & De Boer, B. (1992). *Methodology for the calculation of sustainable national income*. Netherlands Central Bureau of Statistics.
- Hulten, C. R. (1991). The measurement of capital. In E. R. Berndt & J. E. Triplett (Eds.), *Fifty years of economic measurement: The jubilee of the conference on research in income and wealth* (pp. 119–158). Chicago, IL: University of Chicago Press.
- IASB (2010). *Conceptual framework for financial reporting (IFRS Framework)*. IASB.
- IASB/FASB (2006). *Conceptual framework application of the working definition of an asset*. IASB/FASB.
- International Labour Organization (2013). *The prevention of occupational diseases*. ILO.
- Jones, M. J. (2010). Accounting for the environment: Towards a theoretical perspective for environmental accounting and reporting. *Account Forum*, 34, 123–138.
- Katz, E. (1997). *Nature as subject: Human obligation and natural community*. Lanham, MD: Rowman & Littlefield Publishers.
- Kaufman, A., & Englander, E. (2005). A team production model of corporate governance. *Academy of Management Executive*, 19, 9–22.
- Knight, F. H. (1935). The theory of investment once more: Mr. Boulding and the Austrians. *The Quarterly Journal of Economics*, 50, 36–67.
- Krebs, A. (1999). *Ethics of nature*. Berlin: Walter de Gruyter.



- Lamberton, G. (2005). Sustainability accounting – A brief history and conceptual framework. *Account Forum*, 29, 7–26.
- Latour, B. (1993). *We have never been modern*. Cambridge, MA: Harvard University Press.
- Latour, B. (2004a). *Politics of nature: How to bring the sciences into democracy*. Cambridge, MA: Harvard University Press.
- Latour, B. (2004b). Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry*, 30, 225–248.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press.
- Lee, T. A. (1983). The early debate on financial and physical capital. *Accounting Historians Journal*, 10, 25–50.
- Lemarchand, Y. (1993). *Du dépeçage à l'amortissement: Enquête sur l'histoire d'un concept et de sa traduction comptable*. Nantes: Ouest Editions.
- Lukka, K. (1990). Ontology and accounting: The concept of profit. *Critical Perspectives on Accounting*, 1, 239–261.
- Macintosh, N. B., Shearer, T., Thornton, D. B., & Welker, M. (2000). Accounting as simulacrum and hyperreality: Perspectives on income and capital. *Accounting Organizations and Society*, 25, 13–50.
- Magness, V. (1997). Environmental accounting in Canada: New challenges to old theory. *Certified Management Accountants Magazine*, 71, 15–18.
- Magness, V. (2003). Economic values and corporate financial statements. *Journal of Environmental Management*, 32, 1–11.
- Markandya, A., Hunt, A., & Milborrow, I. (2005). Developments in green accounting. In A. Markandya, & M. Tamborra (Eds.), *Green Accounting in Europe – A comparative study* (Vol. 2, pp. 15–33). Bodmin: Edward Elgar Publishing.
- Marshall, A. (1920). *Principles of economics* (8th ed.). London: Macmillan and Co.
- Milne, M. J., & Gray, R. (2013). W(h)ither ecology? The TBL, the GRI, and the institutionalisation of corporate sustainability reporting. *Journal of Business Ethics*, 118, 13–29.
- Neumayer, E. (1999). *Weak versus strong sustainability: Exploring the limits of two opposing paradigms*. Cheltenham: Edward Elgar Publishing.
- Norman, W., & MacDonald, C. (2004). Getting to the bottom of Triple Bottom Line. *Business Ethics Quarterly*, 14, 243–262.
- Norton, B. G. (1991). *Toward unity among environmentalists*. New York: Oxford University Press.
- Paine, R. (1971). Animals as capital: Comparisons among Northern nomadic herders and hunters. *Anthropological Quarterly*, 44, 157–172.
- Palazzo, G., & Scherer, A. G. (2007). Toward a political conception of corporate responsibility: Business and society seen from a Habermasian perspective. *Academy of Management Review*, 32, 1096–1120.
- Pearce, D. (1976). The limits of cost-benefit analysis as a guide to environmental policy. *Kyklos*, 29, 97–112.
- Pearce, D. (1988). Economics, equity and sustainable development. *Futures*, 20, 598–605.
- Power, M. (2010). Fair value accounting, financial economics and the transformation of reliability. *Accounting and Business Research*, 40, 197–210.
- Randall, A. (1994). Thinking about the value of biodiversity. In K. Chung Kim & R. D. Weaver (Eds.), *Biodiversity and landscapes: A paradox of humanity* (pp. 271–286). Cambridge: Cambridge University Press.
- Richard, J. (2005). Les trois stades du capitalisme comptable français. In M. Capron (Ed.), *Les normes comptables internationales, instruments du capitalisme financier* (pp. 89–119). Paris: La Découverte.
- Richard, J. (2012a). *Comptabilité et développement durable*. Economica.
- Richard, J. (2012b). The victory of the Prussian railway dynamic accounting over the public finance and patrimonial accounting models (1838–1884): An early illustration of the appearance of the second stage of capitalist financial accounting and a testimony against the agency and the market for excuses theories. *Accounting Historians Journal*, 39, 89–124.
- Richard, J. (2014). The dangerous dynamics of modern capitalism: From static to IFRS' futuristic accounting. *Critical Perspectives on Accounting*. <http://dx.doi.org/10.1016/j.cpa.2014.09.003> (in press)
- Richard, J., Collette, C., Bensedon, D., & Jaudet, N. (2011). *Comptabilité financière: Normes IFRS versus normes françaises* (10th ed.). Dunod.
- Robins, F. (2006). The challenge of TBL: A responsibility to whom? *Business and Society Review*, 111, 1–14.
- Rose, R. (2009). *Understanding post-communist transformation: A bottom up approach*. Routledge.
- Rubenstein, D. B. (1992). Bridging the gap between green accounting and black ink. *Accounting Organizations and Society*, 17, 501–508.
- Savitz, A. W., & Weber, K. (2006). *The Triple Bottom Line: How today's best-run companies are achieving economic, social and environmental success – and how you can too*. Jossey-Bass.
- Schaltegger, S., & Figge, F. (2004). Environmental shareholder value. In G. Schneider (Ed.), *Ökologie und shareholder value – (k)ein widerspruch* (pp. 11–35). Rüdiger. Schmidheiny and Business Council for Sustainable Development (1992). *Changing course: A global business perspective on development and the environment.. The MIT Press*.
- Schmidt, F. (1921). *Die organische bilanz: im rahmen der wirtschaft*. Leipzig: Gloeckner.
- Scott, M. J., Bilyard, G. R., Link, S. O., Ulibarri, C. A., Westerdahl, H. E., Ricci, P. F., et al. (1998). Valuation of ecological resources and functions. *Journal of Environmental Management*, 22, 49–68.
- Sherman, W. R., Steingard, D. S., & Fitzgibbons, D. E. (2002). Sustainable stakeholder and accounting beyond complementarity and towards integration in environmental accounting. In S. Sharma & M. Starik (Eds.), *Research in corporate sustainability* (pp. 257–294). Cheltenham: Edward Elgar Publishing.
- Snailum, W. W. (1926). *Fifteen studies in book-keeping with a selection of worked and unworked examination papers*. Cambridge University Press Archive.
- Solomon, E., & Laya, J. C. (1967). Measurement of company profitability: Some systematic errors in the accounting rate of return. In A. A. Robichek (Ed.), *Financial research and management decisions* (pp. 152–183). New York: Wiley.
- Spence, C., Chabrak, N., & Pucci, R. (2013). Doxic sunglasses: A response to green accounting and green eyeshades: twenty years later. *Critical Perspectives on Accounting*, 24, 469–473.
- Stern, D. I. (1997). The capital theory approach to sustainability: A critical appraisal. *Journal of Economic Issues*, 31, 145–173.
- Sullivan, S. (2014). *The natural capital myth; or will accounting save the world?* Manchester: The Leverhulme Centre for the Study of Value.
- Swedish Society for Nature Conservation (1999). *Policy for sustainable agriculture*. Stockholm: Birger Gustafsson, AB.
- The German Advisory Council on Global Change (1995). *World in transition: The threat to soils..* Bonn: Economics Verlag GmbH.
- The SIGMA Project (2003). *The SIGMA guidelines*. Retrieved from <http://www.projectsigma.co.uk/guidelines/sigmaguidelines.pdf>
- Thornton, D. B. (2013). Green accounting and green eyeshades twenty years later. *Critical Perspectives On Accounting*, 24, 438–442.
- Turner, R. K. (1993). Sustainability: Principles and practice. In R. K. Turner (Ed.), *Sustainable Environmental Economics and Management. Principles and practice* (pp. 3–36). New York: Belhaven Press.
- Turner, R. K. (1999). The place of economic values in environmental valuation. In I. J. Bateman & K. G. Willis (Eds.), *Valuing environmental preferences* (pp. 17–41). Oxford: Oxford University Press.
- Verfaillie, H., & Bidwell, R. (2000). *Measuring eco-efficiency: A guide to reporting company performance*. World Business Council for Sustainable Development.
- Verstraete, T., & Jouison-Laffitte, E. (2011). *A business model for entrepreneurship*. Cheltenham: Edward Elgar Publishing.
- Weston, A. (1985). Beyond intrinsic value: Pragmatism in environmental ethics. *Environmental Ethics*, 7, 321–339.
- Whiteside, K. (2002). *Divided natures: French contributions of political ecology*. Cambridge, MA: The MIT Press.
- Williams, G., & Phillips, T. (1994). Cleaning up our act: Accounting for environmental liabilities: Current financial reporting doesn't do the job. *Business Credit*, 96, 36.