

Towards a new ecological and human type of national accounting for developing economies (the CARE/TDL model)¹

Jacques Richard*,
University of Paris Dauphine (France)

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Abstract

The goal of this article is to propose a radical reform of the today's financial accounting system of businesses accompanied by a corresponding reform of the system of national accounts. It transforms them into genuine ecological and human systems of accounts that can systematically conserve the three main types of capitals which are necessary for the functioning of any economic system. This is a radical means of overcoming the dramatic ecological and human crisis in which the humanity is buried today. This can be done by applying traditional weapons of capital conservation, invented at the end of the Middle Ages by big capitalists for the protection of their financial investments, to human and natural capital. We notably use the famous double entry accounting depicted by Werner Sombart and Max Weber like certain martial arts use the force of the adversary against him. As a result, we come to a complete redefinition of the main concepts of the economics, especially the concepts of capital, profit and market, and to the possibility of a new type of firm management that allows us to get out of the capitalist system.

Keywords: green national accounting, environmental accounting, human accounting, green finance, ecological accounting against IFRS.

JEL: M00, M41, Q56.

3. The necessary changes in the basic concepts of national accounting

We are going to demonstrate that the basic concepts of added value and GDP (Gross Domestic Product) will be completely transformed by the new national accounting system derived from the CARE/TDL model. We use a simplified example to explain the effects

¹ The final part of the article, see the first part in No. 1.

* E-mail for correspondence: jacques.richard17@laposte.net

of applying the CARE/TDL method both at the micro (businesses) and macro (nations) levels.

We suppose that economy of a certain nation is comprised of only one enormous enterprise X which has just been founded by merging several other businesses. Thus, at the beginning of the observed period, its balance sheet (BS) appears as follows according to the traditional capitalist presentation (NB: units of currency are not given, only the reasoning matters):

Initial BS, Firm X

Assets	Liabilities
Machines, tools, and other assets (MTO) 2000	Financial capital 2000

As is common, workforce and nature do not appear in such a BS, although the workers² are already hired for three years³ at the beginning of the period with a possibility of a renewal. We admit now that for the year to come this company will have three types of activities requiring three types of workforce with different wages: 1) Extraction: 200; 2) Fabrication and sale: 300; 3) Maintenance (of the MTO): 200. The total cost of production and sale is then 700. We admit that the entire production is sold during this period for 1200 to the nation's consumers (including both salaried people and capitalists) and that they consume all of it during the same year.

Let us now present the traditional capitalist balance sheet and P&L statement for this first year before distribution of profits but after wages were paid.

Final BS, Firm X

Assets	Liabilities
MTO (2000 – 200 + 200) 2000	Financial capital 2000
Cash 500	Profit 500

P&L, Firm X

Expenses	Revenues
Wages (total) 700	Sales 1200
Depreciation expenses of MTO 200	Production of MTO 200
Profit 500	

Figures above are the classic ones. The only item that warrants an explanation is the “production of MTO” which represents what the workers in charge of the renewal of machines and tools did. This is indeed an internal production valued at its labour

² The category of “workers” is to be understood in a very large sense as encompassing every person that works in a nation, including financial capitalists that, beyond their contribution in the form of financial capitals, also devote their time to some work inside a firm.

³ This short length of time is chosen for simplicity of treatment.

cost that makes revenues go up and enables the maintenance of the financial capital, for instance, of machines and tools⁴.

Now, what is the traditional presentation of national accounts in the case of this “firm/nation”? We know that the traditional accounting instrument of national accounts is a kind of P&L focused on the concept of added value popularised under the name of domestic product (DP). Two types of domestic products are generally calculated: the Gross Domestic Product (GDP), and the Net Domestic product (NDP). The first one is calculated before the deduction of the depreciation of the long-term investments, the second one – after this deduction. Since the GDP is incorrect from a theoretical point of view, we focus on the NDP here. It can be calculated in two different ways: the deductive process and the additive process. For the deductive process, we deduce the depreciation expenses from the production during the period. In the case of X, the net added value of the period is equal to 1400 (global production) minus 200 (depreciation expenses), which brings us to a total of 1200. For the additive process, we have to add all the items corresponding to the distribution of the net added value, which is 700 (wages) + 500 (Profit) that equals 1200. In either case, the NDP of the period is equal to 1200. As a conclusion, we put emphasis on the fact that the figures we used are all directly taken from the capitalist model of accounting for businesses without any major correction.

Now we take the case of the CARE/TDL model. We examine two different situations. In the first one, we assume that this capitalist firm is (nevertheless) perfect, as far as the preservation of both NC and HC is concerned, and uses the CARE/TDL model⁵. More realistically, in the second case it does not respect the preservation of these capitals.

A. The first case (perfect sustainability). To simplify, the capitalist firm/nation pays its workers enough to preserve the labor force and respects all the criteria of resilience in using the natural capital. On this basis we show, first, the initial BS, then the final BS and the P&L.

Initial BS Firm X

Assets		Liabilities	
MTO	2000	Financial capital	2000
Work force (CU)	2100	Human capital	2100

In this balance sheet, the company owes its employees a debt of 2100 for a period of three years (it means 700 a year). This debt is registered at the time of their recruitment as the human capital on the liabilities side. The counterpart of this capital-debt is the cost of use (CU) of this human capital for the same period (and not the workforce or, even worse, the worker him/herself, like at the time of slavery). The natural capital does not appear because this firm, on account of its good ecological management, does not need to plan a budget for resilience. One year later, the situation is as follows:

⁴ We are aware that valuation of the cost of products that are not sold, such as maintenance of the machines and tools, can create problems, but these are secondary questions. We operate here according to the famous principle of prudence which has been dominating the scene in capitalist business accounting for centuries.

⁵ In a sense, this firm is no longer a capitalist one.

Final BS, Firm X

Assets		Liabilities	
MTO (2000 – 200 + 200)	2000	Financial capital	2000
Work force (CU) (2100 – 700 + 700)	2100	Human capital	2100
Cash	500	Common profit	500

The “fate” of the human capital is totally in line with that of the financial capital. This human capital was conserved thanks to the “reinvestment” of a normal pay (700) taken from new resources (cash) associated with the sales. This allowed the new cost of using employees to be equal to their capital to be maintained (2100). This situation can be compared to that of the financial capital: the mechanisms of conservation are strictly identical. This equality can also be noticed at the level of the P&L statement.

P&L Firm X (CARE/TDL)

Expenses		Revenues	
Depreciation expenses of the HC	700	Sales	1200
Depreciation expenses of the FC	200	Production of MTO	200
Common Profit	500		

If the revenues are unchanged in form and content, expenses are a whole different story. We are no longer concerned with wages but with “depreciation expenses of the human capital”. Here again, the symmetry with the financial capital’s treatment is totally respected: in both cases it is a matter of depreciation of capital to be maintained. The workforce has been treated as a capital to be maintained for itself and no longer as a simple means and a burden on the financial capital. This equality of fate for both FC and HC is also at stake in the matters of profit. Since two capitals are necessary for the company’s activities and identified as having equal “rights”, one has no choice but to admit that they both contribute to the profit registered for the period. Consequently, the profit is no longer that of the financial capital but “common profit”. These two main changes in the treatment of expenses and profits will have enormous consequences for the concepts used in national accounting if we apply the principles of the CARE/TDL method to this kind of accounts.

Let us first take the case of expenses. Earlier, according to the deductive approach, we figured out the NDP by deducting the depreciations of the financial capital from the whole of revenues (or product). This is normal since we have to take the use of the financial capital during the period into account. What is not normal is that this rational treatment is not applied to the human capital! If we consider there is no net product until we have deducted the expenses for the financial capital’s conservation, logic dictates that we accept the necessity to do the same for the human capital’s depreciations. In other words, it means at least two main lines of depreciations are to be deducted from the GDP to get the NDP – the depreciation of the FC, and the depreciation of the HC. It is only after we made these two types of deductions that we can speak of a net product according to the CARE/TDL method. In that case, the normal “wages” (700) paid

to the workforce for their preservation, and thus only for the preservation of their capital, should not be considered a revenue but only a compensation for the use of this human capital. It is the same thing for a capitalist: the compensation for the use of his financial capital (the depreciation expenses) cannot be considered an element of his net product, i.e. his financial profit. All this reasoning implies that in our case the NDP calculated according to the deductive approach is absolutely not equal to 1200 but only to 500 ($1400 - 200 - 700$). The traditional calculation of the NDP's obvious mistake is also repeated in the additive mode of calculation which generally boils down to summing up the profits and the wages (in the simple case where there are no interests and no taxes). The error here is to assimilate wages and profits. This assimilation is completely biased (fraught with a bias). In traditional accounting, while profit is a surplus after systematic conservation of the financial capital, wages are a contractual (market) allocation that for the great majority of human beings is barely enough to support their lives, let alone the part of population who are starving. In the CARE/TDL approach, we do not talk about a surplus for the HC as long as it has not been paid for its preservation. Thus, as a conclusion, in our case the normal "wages" of 700 are only a compensation for maintaining the human capital, not a part of an "added value". Only the (new) profit of 500 can be considered an element of the NDP once every new "capitalist" has preserved their capital⁶. This leads us to the following comment on this new concept of profit.

In a pure financial capitalist view, which is also the view of the traditional theory and practice of national accounts, the profit is the excess above the financial capital which remains at the disposal of financial capitalists. This is not the case in the CARE/TDL method. In this method, the profit is defined as the *common* surplus after the conservation of the three main capitals that are the NC, the HC, and the FC. It can be seen as the "true economic profit" since this new kind of economics really cares for all three capitals equally. In a way, we can talk here about a kind of "tri-capitalist view" (Richard, 2012). This article's goal is not to study the conditions under which this common profit has to be certified by new (independent) auditors and distributed among the new "capital-holders" as defined by the CARE/TDL approach (for that, see Richard (2015b) and Richard and Rambaud (2018)). Here we only use this concept of a common "true economic profit" to redefine the concept of the NDP. To conclude, the new P&L statement (or set of P&L statements) that will be the basis for the calculation of the new concept of a sustainable NDP appears as follows:

1) Calculation of the NDP (deductive method)

Expenses	Revenues (products)		
Depreciation expenses of the HC	700	Sales	1200
Depreciation expenses of the FC	200	Production of MTO	200
NDP (net added value)	500		

⁶ Financial capitalists will also maintain their human capital if they agree to work, which should be the case in a normal society.

2) Distribution of the NDP (net added value)

Distribution to the HC	X	NDP (net added value)	500
Distribution to the NC	Y		
Retained added value	Z		

Here we have a situation in which companies and other entities that make up the nation already respect the criteria laid for a sustainable management according to the CARE/TDL method. In fact, this refers to an optimal situation, so we need to work on a more realistic and complex case.

B. The case where businesses and national entities do not respect the 12 principles of the CARE/TDL model. Let us modify our case and change some data. We will take two kinds of problems into account. The first one has to do with the natural capital: we now admit that X's management style is not compatible with genuine ecological sustainability, and that transformation of this management implies a series of new costs at all levels of the firm. More precisely, we suppose that a new sustainable management requires a rise of 420 of all initial costs in the initial BS with hiring new employees and materials, both *specialised in ecology*. This amount constitutes the NC in the new initial BS for a period of three years. But we will also introduce another complication. We suppose now that, unlike in the previous case, the level of wages of the "old" employees is below the normal rate, which does not allow both real conservation and "normal" life, and that to reach this level, a general rise of 10% is necessary. Therefore, the human capital should be increased from 2100 to 2310 (for three years). We can now give a new version of the initial BS.

Initial BS, Firm X (CARE/TDL)

Assets		Liabilities	
MTO	2000	Financial capital	2000
Work force (CU)	2310	Human capital	2310
Specialised assets (CU)	420	Natural capital	420

The rest of the reasoning is in accordance with the previous developments. We give now the final BS and the corresponding P&L statement at the end of the first period. We suppose here that the firm has *not* taken the measures necessary to cope with the human and environmental situations, a mistake that will appear in its CARE/TDL balance sheet.

Final BS, Firm X (CARE/TDL)

Assets		Liabilities	
Machines and tools (2000 – 200 + 200)	2000	Financial capital	2000
Work force (CU) (2310 – 770)	1540	Human capital	2310
Specialised assets (CU) (420 – 140)	280	Natural capital	420
Cash	1200	Common profit	290

In that case, two important events appear in the accounts. First, profit is reduced to take the real ecological and human situation of the firm into account. Second, the simple perusal of the balance sheet allows the reader to understand that the firm has not respected its obligation to preserve natural and human capitals: it has not invested money to preserve it despite having sufficient cash. Thus, it becomes easy to precisely calculate the *level of indebtedness* of the firm to the human capital and the natural capital by comparing the unpaid amount to the total of the debt registered on the liabilities' side.

Indebtedness to the human capital	$770/2310 = 33,3\%$
Indebtedness to the natural capital	$140/420 = 33,3\%$

It is only the presence of the human and ecological balance sheet that makes this type of calculation possible. We will later show the importance of a true and complete set of accounting documents that includes a national balance sheet when we will discuss and criticize some national accountants' attempts at evaluating state environmental burdens without the help of balance sheets. Let us now give the corresponding P&L statement to complete the scene.

P&L, Firm X (CARE/TDL)

Expenses		Revenues	
Depreciation expenses of the HC	770	Sales	1200
Depreciation expenses of the NC	140		
Depreciation expenses of the FC	200	Production of MTO	200
Common Profit	290		

Compared to the past situation, the common profit of the NDP has now decreased from 500 to 290. This result will also appear in our CARE/TDL national income statement:

Calculation of the NDP (deductive method)

Expenses		Revenues (products)	
Depreciation expenses of the HC	770	Sales	1200
Depreciation expenses of the NC	140	Production of MTO	200
Depreciation expenses of the FC	200		
NDP (net added value)	290		

Let us now compare our accounting model with the (classic) pure capitalist model. Below we see figures for the latter according to the deductive model:

Calculation of the NDP (deductive method)

Expenses		Revenues (products)	
Depreciation expenses of the FC	200	Sales	1200
NDP (net added value)	1200	Production of MTO	200

As is shown, despite all the changes introduced by the problems relative to the national firm's situation, the "official" NDP remains the same. Discrepancy between the apparent added value (or NDP), i.e. 1200, and the real added value (290) reaches 910. In the previous case (with all conditions of sustainability respected), this discrepancy was only 700 (1200 – 500). The marginal rise of 210 can be explained by the complete absence of consideration for the natural and human capitals' real situations. It means that the damages they sustained in regard to maintenance standards were not taken into account. Consequently, the sum of the effects of this absence of ecological and human considerations and the false conception of added value explain the global environmental gap (when compared to the macro CARE/TDL model). This kind of traditional national accounting is a pure representation of the capitalist accounting ideology – ideology based solely on conservation of financial capital and on its corresponding concept of profit. In conclusion, we want to emphasize how valuable correct balance sheets are for calculating important environmental information. Some environmental economists, like Ekins et al. (2018; see below), propose that we compare the sum of the environmental costs to be paid to guarantee the functions' resilience with the traditional NDP's total in order to indicate the "intensity of environmental monetary unsustainability"⁷. In our example, this ratio would look as follows:

$$\frac{\text{Total environmental expenses to pay for three years}}{NDP} = \frac{420}{1200} = 35\%$$

Actually, this ratio is supposed to give an idea of the pressure of the environmental debt on the revenues dedicated to the funding of environmental expenditures. There are two reasons why this is not a valid indication. The first one is that it compares three-year-long expenses with one-year-long revenues. The second one is that it implicitly considers that all revenues, including the revenues from the preservation of the human capital, are available for financing the environmental expenses. Even in traditional capital finance, this is not the case. Generally, only profits are considered when performing this type of calculation. If we take these two points into account, the correct ratio should be:

$$\frac{\text{Total environmental expenses to pay for three years}}{NDP} = \frac{420}{1200} = 35\%$$

This kind of indicator measures the possibility of paying the environmental debt while the first one measured the degree of indebtedness. In both cases, it appears that only the CARE/TDL model may provide adequate figures.

Here we complete the presentation of the bases of the CARE/TDL method for the reconstruction of business and national accounts. Further, we are going to compare

⁷ "The ratio between the sum of M-ESGAP across the environmental and resource indicators (G-ESGAP) and GDP may indicate the 'intensity of environmental monetary unsustainability'" (Rees & Wackernagel, 1999).

this conception with some major works on environmental (and/or, more rarely, social) national accounting systems that try to remedy the defaults of the classic capitalist one.

4. Some distant and recent attempts to rebuild the capitalist national accounting system, their evaluation and comparison with the micro-macro CARE/TDL model

4.1. Presentation of the issue: A wide range of environmental accounting systems

In the old days, there were many attempts to restructure national accounts in an ecological and/or human way (see, notably, Richard, 2012). After initial steps in the works by Kapp (1950), Ciriacy-Wantrupt (1952) and Georgescu-Roegen (1971), these new types of national accounts began to emerge massively in the 1970s. They are characterised by very different features. There is a huge gap between those based on non-monetary units and those that rely on the use of monetary valuations. In the first category we can find those based on eco-points (for example, Müller-Wenck, 1972), on units of solar energy (such as the works of Odum (1971), and Pillet (1998)), and those based on units of land surface, such as the ecological footprint developed by Rees and Wackernagel (1999). These attempts at developing non-monetary systems of national accounts deserve respect and interest, especially since they are generally conceived within the frame of a strong conception of sustainability in reference to ecological limits (Richard, 2012, 64–67). But, unlike the CARE/TDL method, they have no ambition to replace today's dominating systems of accounting based on monetary valuations, such as the IFRS and the national GDP or NDP. This is the reason why our comparison focuses on environmental and human monetary systems of accounting, more specifically, on those that should be used as national accounts. This last category can be divided into SNA which will rely on a weak sustainability approach, and those that, on the contrary, will rely on a strong one.

Among the first ones we find mainly the Sustainable Measure of Economic Welfare (SMEW) initiated by Nordhaus and Tobin (1972), the Index of Sustainable Economic Welfare (ISEW) by Daly and Cobb (1989), the Genuine Progress Indicator (GPI) by Cobb and Cobb (1994), the System for Environmental-Economic Accounting (SEEA, 2003) promoted by a range of international organizations (notably, the UNO, the EU, the OECD, the IMF and the WB), and the Genuine Saving model as first conceived by the World Bank in their book "Where is the Wealth of Nations" (2006). All these types of accounting share the same fault: they allow compensations between the three types of capitals, as shown by Meda (1999, notably, pages 338 and following), Richard (2012, notably ch. 6–7), Gadrey & Jany-Catrice (2012) and, more recently, Ekins et al. (2018). That is why we do not pay attention to these models, although they unfortunately represent what can be considered modern mainstream approach. For us, they cannot

be proper models to deal with today's environmental and human crisis (for more details see Richard, 2012, and Ekins et al., 2018)⁸. Instead we compare the CARE/TDL model with the (rare) attempts aiming at strong sustainability in the frame of monetary accounts. It was the Dutch economist Hueting who made the first commendable proposal. In 1989, he suggested to abandon the neo-classical environmental accounting systems based on cost benefits analysis which aimed to get an ecological optimum through the internalisation of externalities. Instead he proposed to calculate the global cost of maintaining or restoring the nation's environmental functions taking into account environmental scientific-based limits that must be strictly respected⁹. The ultimate goal is to recalculate the true costs of all products and thus to enable the maintenance of the environmental functions necessary for life. These additional costs are deducted from the GDP as "costs of environmental functions" (see Hueting (1989); Hueting et al. (1992); and comment by Richard (2012, 77–81)). Almost at the same time, a similar proposal is made by the British economist Ekins (Ekins, 1992). As far as we know, to this day, these are the only works on the new types of monetary based accounts that seem to revolve around a strict, strong sustainability approach. P. Ekins recently proposed a new version of his former work with two other colleagues (Ekins et al., 2018), and this recent version is the basis for our comparison with the CARE/TDL model.

4.2. Analysis of the "single indicator of strong sustainability for development"

This article's philosophy (Ekins et al., 2018)¹⁰ shows strong similarities with our CARE/TDL model, which indicates that Ekins et al. are heading in the same direction. We are going to demonstrate that the CARE/TDL model goes further and can be considered as a complementary proposal to achieve Ekins and his co-authors' goals.

4.2.1. Common points

a) Firstly, the choice of a strong type of sustainability. From the very beginning the authors clearly express their preference for a strong sustainability approach as it is the case for the CARE/TDL model. Three main arguments explain their choice. The first one goes

⁸ As far as valuation is concerned, some of the models quoted in the previous paragraph, like the SMEW, the ISEW and the GPI, choose a kind of historical cost accounting. Others choose a kind of Fisherian approach: the SEEA and the Genuine Saving (Richard, 2012, 105–119). The choice of the historical cost approach for valuation could be considered as a possibility of improving the "old-fashioned" models such as the SMEW and its derivatives. One could consider that, thanks to their transformation in favor of a strong sustainability approach, they could get closer to a kind of ecological accounting. On the contrary, the choice of a Fisherian value on the part of the SEEA and the Genuine Saving automatically ruins every chance of their transitioning into ecological (and human) accounting. These two types of models, especially the Genuine Saving model, can be considered as pure antitheses of true ecological accounting (Richard, 2012, ch. 6).

⁹ This courageous approach will earn him the criticisms of the tenants of the economic (Fisherian) types of valuation (see the critics by Vanoli (2002, 440)).

¹⁰ This paper will be quoted throughout this subparagraph (unless otherwise specified).

as follows: “It is possible to shift to a weak sustainability position where that is shown to be appropriate”. The second one is: “The destruction of manufactured capital is very rarely irreversible... whereas irreversibility ... is common in the consumption of natural capital”. And in the third one, invoking Victor et al. (1998, p. 206), the authors identify some elements of natural capital that are essential for life (pp. 13–14). Thus, they underline: “Important environmental functions may be considered to be those that are not substitutable, those whose loss is irreversible and is likely to lead to “immoderate” losses (that is, those considerably greater than the costs of maintaining the functions), and those that are crucial for the maintenance of health, for the avoidance of substantial threats (such as climate stability), and for economic sustainability. The natural capital that performs such environmental functions may be called critical natural capital”¹¹ (p. 25).

This leads them to giving priority to maintaining natural capital among the four types of capitals that they identify (see below): “The four types of capital can be ranked in order of temporal priority, if not of present economic importance. Natural capital came first, providing the conditions for the evolution of humans and other life on earth” (p. 9).

b) Secondly, the necessity to have scientific targets (limits) for achieving strong sustainability. The authors want to compare environmental performance indicators with scientific environmental targets so as to get distance to (scientific) targets indicators (p. 21). “The difference between standards and environmental state or pressure indicator showing the current situation may be described as the ‘Environmental Sustainability Gap’ (ESGAP), in physical terms, between the current and a sustainable situation” (p. 44).

The reference point (i.e. the scientific target) has to be “indicative of an acceptable level of environmental functions”. This reasoning leads them to distinguish standards and limits (or scientific targets): “*An environmental limit* represents a point beyond which non-linear dynamics significantly change the functions and/or structure of an ecosystem... *Environmental standards* are intended to depict the stock and quality of natural capital required... *Environmental targets* usually deviate from the previous science-based reference points...” (p. 39–40).

On behalf of that necessity, they deplore that “most environmental indicators developed by European institutions¹² do not meet these criteria”. They also stress that “Distance-to-target indicators, such as the environmental dimension of the Sustainable Development Goals, the Environmental Performance Index or the Planetary Boundaries dashboard, also fail to meet at least one of the criteria above.” (p. 60). The authors point out that their brief review “reveals the continuing absence of a credible environmental sustainability indicator system at the national level, which could be used to inform policy makers” (p. 3). We share these hopes and conclusions as they also are basic elements of the CARE/TDL model appliance.

¹¹ Here they quote Ekins et al., (2003) where an interesting distinction between “functions for” and “functions of” is introduced: the “functions of” the environment is those which maintain the basic integrity of natural systems in general and ecosystems in particular. These functions may be essential for the continued operation of other functions and to maintain the biosphere from which they derive.

¹² Notably mentioned in the reports EEA (2016), and EEA (2017).

c) Thirdly, the choice of valuing the distance to strong (environmental) sustainability with costs. Ekins and his co-authors rejected the weak sustainability hypothesis. As was the case with Hueting, they make a conscious choice to abandon the evaluation of environmental costs on the basis of discounted damages (negative externalities) in favour of the measure of the costs necessary for maintaining the functioning of different natural capitals¹³.

They claim that “when the ESGAP does not represent an irreversible effect, it will be possible to estimate the monetary costs of meeting the sustainability standards (M-ESGAP)” (p. 33). They add that “because the M-ESGAPs for different functions are all expressed in the same unit, it would be convenient to aggregate them to compute an overall Gross ESGAP, or G-ESGAP, for the economy as a whole. This could then be used to indicate the economic ‘distance’ to environmental sustainability in relation to the present situation and practices. The G-ESGAP will decrease either as the environment improves (reducing the ‘physical’ sustainability gap), or as technologies of abatement, avoidance or restoration become cheaper” (p. 45). This conception of valuation on the basis of maintenance cost is at the heart of our CARE/TDL model.

4.2.2. Differences

Our five principal items are (in order of growing importance): (1) the object of the new system of information, (2) its goals, (3) its relation to a concept of capital, (4) its relation to the concept of profit, and (5) consideration (or not) of the matters of governance.

a) The object of the new indicator. This is the most obvious difference with the CARE/TDL model. Despite the fact that Ekins and his co-authors deal with four capitals, they only deal with the conservation of the natural capital, excluding the treatment of the human and social ones. But this can be considered a secondary difference since the methodology proposed by Ekins could be extended to other types of capital.

b) The goal of the new “single indicator”. The CARE/TDL model’s end goal is not only to give information on environmental problems, but also to offer a way of replacing the old

¹³ Considering how important it is, we *replicate* this reasoning in detail: “In economics a natural way in which to frame the idea of sustainability is in terms of a capital stock and the goods and services that flow from it. The value of a capital stock is that of the discounted present value of the flows from it over its lifetime, and the sustainability of the flows will depend on the whether the capital stock is maintained over time, with investment making good any depreciation”. Sustainable development came to be framed, by economists at least, as a non-declining, and perhaps increasing level of human welfare (see, for example, Pezzey (1992), p. 55ff), something that can easily be related to the conception of wealth creation set out. “However, given that there are different forms of capital, this immediately raises the question as to whether it is the capital stock as a whole that should be non-declining or whether the individual types of capital, or some parts of them, should be non-declining as well. This is the difference between weak and strong sustainability”. “The economic approach to this issue seeks to calculate the monetary value of the damage to the environmental functions caused by economic activity, measured in terms of the loss of human benefits to which the damage gives rise, to compare this with the benefits from the economic activity, and to equate the marginal loss due to the former with the marginal gain due to the latter in order to maximise the delivery of benefits overall. While this is a reasonable way of proceeding in principle, in practice it encounters a number of major problems... The results of the damage are very uncertain, but may be very large (even catastrophic). The results may be irreversible. The results will play out over the very long term... The alternative approach to be explored here is on strong environmental sustainability” (p. 8, 12, 24–25).

capitalist business and national accounting systems in all their concepts, dimensions, and documents. We will indeed change the economic system with new economic global indicators encompassing a “proper” treatment of all capitals.

In the case of the authors of the “single indicator”, the goal is “only” to reach a strict, strong sustainable development with a focus on environmental matters independently from global economic and accounting devices. Even in their most recent article (Ekins et al. 2018), they do not present an accounting system, not even reduced to a national accounting system. Strikingly, the word “accounting” never occurs, which is all the more astonishing as they compare their single indicator to true national accounting models such as the SMEW, the SEEA, and the Genuine Saving of the World Bank. And they clearly express why. They state that their indicator makes no pretence to replace the economic indicators. Obviously, they refuse or, at least for the while, do not intend to modify the mainstream national accounts. They do not explain this fundamental choice, although it creates a radical divide between “economic” and “environmental” indicators and implies that it is impossible to get rid of the concept of financial profit. On our part, we believe this choice was influenced by former “bad examples” like when the aforementioned SMEW, SEEA and GS tried to revise national accounts and turn them into kinds of national environmental accounting. They rightfully criticized the latter as a means of fostering a weak sustainable type of development. In their opinion, any addition of environmental costs and “economic costs and values” will lead to calculating a revised GDP or NDP that will allow a compensation of environmental losses with bigger financial profits – a typical case of a weak sustainability. This is why they prefer a single separated (not infected) environmental indicator. As it appears, this choice is based on the conviction that any mixing of “environmental” and “economic” data in an accounting system will automatically lead to weak sustainability. However, we've proved the opposite. Notably thanks to the three separated lines of capitals (and their uses) in the CARE/TDL balance sheet, it is perfectly possible to calculate a common new economic result that is obtained in the frame of a separate and systematic preservation of the three main types of capitals. The problem Ekins and his co-authors, as well as many other economists, encountered is fundamentally the lack of adequate conceptualisation of a new type of balance sheet that would include a concept of human and environmental capital as separate debts. This may be connected with the long-running tradition of national accountants who dealt only with flow indicators such as GDP and NDP, not with stock indicators such as balance sheets, and also ignored the peculiarities of traditional business accounts, notably their concept of capital as a debt, the last element being a quasi-general one as far as economists are concerned.

c) The concept of capital. Since Ekins and his co-authors are all economists, it is logical that they use a totally different approach to capital than we do, at least as far as definitions go. Indeed, they define capitals as assets to be used to get services and not as liabilities, as in the CARE/TDL model. They state: “Human well-being and wealth creation is underpinned by four types of capital assets: manufactured, human, social and natural. Each of the capital stocks produces a flow of services that is used to generate goods and services, but also ‘bads’ in the form of depreciation and pollution/wastes” (p. 7).

According to them, the manufactured (or human-made, or physical) capital “is what is traditionally considered as capital: produced assets that are used to produce other goods and services. Some examples are machines, tools, buildings, and infrastructure” (p. 8). But they want to extend this notion of capital because “it is clear that flows of benefits derive from many other sources than manufactured capital, so that the concept of capital has been extended in a number of directions” (p. 8). Thus, they add three other capitals: the human capital, the social capital, and the natural capital to get a “4-capitals model”¹⁴ (Ekins et al., 2018, p. 8). The human capital “generally refers to the health, well-being, and productive potential of individual people. Types of human capital include mental and physical health, education, motivation and work skills. These elements not only contribute to a happy, healthy society, but also improve the opportunities for economic development through a productive workforce” (p. 8). The natural capital “in addition to traditional natural resources, such as timber, water, and energy and mineral reserves... includes broader natural assets, such as biodiversity, endangered species, and the ecosystems which perform ecological services (e.g. air and water filtration) that absorb and neutralize human wastes. Natural capital can be defined as the components of nature that can be linked directly or indirectly to human welfare, and has been formally defined as ‘the elements of nature that directly and indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions’¹⁵” (p. 8). Although the goal clearly is to preserve the human and natural capitals, at least the critical ones, these capitals are treated as assets producing services. Hence, as they emphasise, “environmental sustainability is characterised by the maintenance of the capacity of natural capital to provide relevant goods and services” (p. 7). We have showed that with such a conception of a single-entry accounting and focusing on the services “provided” by the natural capital, it is clearly impossible to have a complete accounting system that allows full description of both ecological and human capital debts.

d) *The concept of profit.* In a remarkable way that contrasts with the mainstream neo-classic economy, Ekins and his co-authors assert that profit is a kind of *common profit* resulting from “the interactions between the different kinds of capital”, and that in such a case “it is effectively impossible to identify and separate out their individual productive capacity” (p. 9). We agree with this position. But, as opposed to the CARE/TDL model, they never propose a new definition of profit, although they clearly show that a stronger protection of environmental functions will cause both firms and nations’ costs to rise. As they state, the very motive of monetary valuation of the ESGAPs is not so much a transformation of the management of the firms and nations as chiefly a means for governments to have some idea of the global importance of the sums at stake, or that could be at stake, in the case of their intervention in the reduction of the ESGAPs at the national level.

¹⁴ Quoting Ekins (1992, pp. 147–151).

¹⁵ Quoting NCC (2014, p. 21).

5. Conclusion

We live in times of huge human and ecological crises (see Alvaredo et al., 2018; Bonneuil & Fressoz, 2013) in the context of the new Anthropocene era (Lewis & Maslin, 2015; Moore, 2017). These crises must be resolved by drastic economic and political measures. Only a few “ecological economists”, such as Hueting, Ekins and their co-authors, conceived systems of indicators within the frame of a strong sustainability approach abandoning the theory of internalisation of externalities promoted by the mainstream school of “environmental economists”. Up to now, though, they have not been in a position to formulate a complete integrated system of accounting that could compete with and replace today’s capitalist system of business and national accounts. We believe their valuable work could be extended upon and improved, notably for the use in developing countries if applied within the frame of the micro/macro CARE/TDL system. This could help put an end to the terrible pressure of capitalist financial accounting on the biosphere.

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