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The “Triple Depreciation Line” (TDL) accounting model and its application to the Human Capital

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Abstract:

As an introduction, in a first part, we give a critical analysis of the standard Human Capital theory, with the help of some “traditional” accounting concepts. In particular, we show that this theory is based on a (deliberate) confusion between assets and capital. In order to avoid this issue, we introduce the “Triple Depreciation Line” (TDL) (financial) accounting model, developed in (Rambaud & Richard, 2015), as a concrete way to design an accounting model able to treat “Human Capital”, as a real accounting capital – a matter of concern – that firms have to protect and maintain. Therefore, in a second part, after a brief presentation of this accounting model, we explain how to apply it to the “Human Capital” case. This application allows a discussion about some key issues about this notion and the difference between the standard perspective on Human Capital and the “accounting” one. Finally, we present some important consequences of this accounting model for the Human Capital: the disappearance of the concept of wage and the possibility to report repeated uses of the Human Capital directly in the balance sheet.

Keywords: human capital, asset, triple depreciation line, financial accounting, integrated reporting, occupational disease, working conditions

I. Introduction to the Human Capital issue

I.1. Human Capital in Economics

The economic notion of Human Capital (HC) has a quite long history (Fleischhauer, 2007; Folloni & Vittadini, 2010; Kiker, 1966; Le, Gibson, & Oxley, 2005). One of the first attempts to assess the monetary value of a human being was made by William Petty around 1691 (Kiker, 1966). His goal was to “[...] *demonstrate the power of England, the economic effects of migration [...], the money value of human life destroyed in war [...], and the monetary loss to a nation resulting from deaths [...]*” (Kiker, 1966). With this aim in mind, his evaluation of human capital was based on a capitalization of wages to perpetuity, at the market interest rate, but without allowance for the cost of maintenance of workers before capitalization (Kiker, 1966). The notion of HC was also present in the work of Adam Smith (Spengler, 1977), although the expression “human capital” was not used. In his category of fixed capital, a part of the “*general stock of the society*” (Smith, 1904), he included “[...] *the acquired and useful abilities of all the inhabitants or members of the society [...]*” (Smith, 1904). According to him, “*the acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person*” (Smith, 1904). Therefore, the evaluation of the Smithian HC relied on costs. This cost-based approach was mainly developed by Ernst Engel (1883). He proposed to estimate HC through child rearing costs to their parents. “[...] *the cost of rearing a person was equal to the summation of costs required to raise him from conception to the age of 25, since the author considered a person to be fully produced by the age of 26*” (Le et al., 2005).

The modern theory of HC was developed from the 1960s. For instance, Theodore Schultz (1961) was one of the first author to really use the term “human capital”. He defined it as “[...] *useful skills and knowledge [...]*” (Schultz, 1961) acquired by people. According to him, expenditures on HC had to be classified as investments rather than consumptions. He proposed to extend the way a classical investment in physical capital good is valued, “[...] *by discounting its income stream [...]*” (Schultz, 1961), to human investments: therefore, “[...] *the value of the investment can be determined by discounting the additional future earnings it yields [...]*” (Schultz, 1961). At the same period, several other authors, like Burton Weisbrod (1961), Jacob Mincer (1958) and in particular Gary Becker (1964), worked on this notion, in accordance

with the perspective of T. Schultz. Thus, from their common perspective, HC is an asset, based on skills, knowledge, health and values (Becker, 1964) of human beings. This asset is associated with human productivity and with wages. Indeed, investing in HC, *i.e.* investing in education, in “on-the-job” training (provided by employers), “off-the-job” training (post-school training provided by “for-profit” proprietary institutions) (Fleischhauer, 2007) and medical care (Becker, 1964), means developing the productive potential of people, and by way of consequence, their future wages. Therefore, a wage can be considered as the yield of HC, the remuneration of investments in HC. In these conditions, it is natural to assess the HC at the discounted future earnings (incomes) that yield from investments in HC.

From this economic modern viewpoint, HC is seen as a cornerstone of the new growth theories (Aghion & Howitt, 1997; Lucas, 1988; Romer, 1986, 1990, 1994). Indeed, in 1956, Robert Solow (1956) showed that “*in the absence of population growth and technological change, diminishing returns will eventually choke off all economic growth*” (Aghion & Howitt, 1997) and that, even if we suppose a population growth, “[...] *growth as measured by the rate of increase in output per person will cease in the long run*” (Aghion & Howitt, 1997). Therefore, in order to be able to explain (or rather to justify the pursuit of) growth, new “ingredients” were needed. Technical progress is generally speaking considered as this new ingredient. And behind this progress, there is, in a way or another, human capital. For instance, according to Robert Lucas (1988), the accumulation of human capital in the educational system constitutes the main explanation of the positive externality at the origin of the accumulation of technical progress. For Paul Romer (1990), this progress depends on investments in research, through R&D, which leads to an accumulation of knowledge; moreover, “[...] *devoting more human capital to research leads to a higher rate of production of new designs [... and] the larger the total stock of designs and knowledge is, the higher the productivity of an engineer working in the research sector will be*” (Romer, 1990). Finally, P. Romer concluded that “[...] *an economy with a larger total stock of human capital will experience faster growth [... and] low levels of human capital may help explain why growth is not observed in underdeveloped economies that are closed [...]*” (Romer, 1990).

Therefore, HC is fundamentally related to investments in and accumulation of human-based characteristics which can secure future growth, at a social level, and future wages, at an individual level, through the increase of human productivity. As an outcome, there exist two main ways to estimate the monetary value of HC (Fleischhauer, 2007; Kiker, 1966; Le et al.,

2005): the “input-based” approach, defended recently by John Kendrick (1976) and Robert Eisner (1985, 1988), which relies on the costs to produce this human capital (in accordance with the perspective of A. Smith or E. Engel); the “output-based” approach, which is the prevailing viewpoint, which rests on capitalized earnings, generated by HC.

The notion of HC is also connected to sustainability (Atkinson, Dietz, Neumayer, & Agarwala, 2014; Elliott, 2012). Indeed, the concept of capital and the debates about its maintenance and development have become the standard basis to grasp sustainability today. Indeed, at the end of the 1980s, this concept was interpreted in terms of natural capital maintenance, thanks, namely, to the work of David Pearce (Pearce, Markandya, & Barbier, 1989; Pearce & Turner, 1990; Pearce, 1988), and also through the enhancement of HC (Repetto, 1987). From this perspective, which we can call the “capital approach” (Ruta & Hamilton, 2014), sustainability requires at least a constant stock of natural and human capital (where natural capital is defined as “*a stock of natural assets serving economic functions*” (Pearce, 1988)).

I.2. Human Capital in (financial) Accounting

The recent “Human Capital Reporting” report¹ (CIPD & PIRC, 2015) claims that “*human and intellectual capital form a significant part of the competitive advantage of twenty-first-century organisations, and yet remain out of view for most firms’ critical stakeholders*” (CIPD & PIRC, 2015). This observation can be connected to the famous corporate dualism: on the one hand, organisations claim that “*people are our most important asset*” (Jordan, 2005) but, on the other hand, they do not include them into financial reporting. In fact, the integration of HC in financial statements is not a new issue (Lev & Schwartz, 1971). Indeed, at the end of the 1960s, Social and Environmental Accounting emerged (Linowes, 1968, 1972; Mobley, 1970) and one of its first tasks is to incorporate (in a way or another) human and social concerns in conventional accounting (Mathews, 1997). The first real and concrete attempt for this integration was proposed by the consulting firm, Clark C. Abt and Associates company, in 1972 (Centre for Social & Environmental Accounting Research, 2015; Estes, 1976). This firm

¹ This report was written by the professional association CIPD (Chartered Institute of Personnel and Development) in conjunction with Pensions & Investment Research Consultants Ltd (PIRC) and in partnership with the UK Commission for Employment and Skills, the association “Investors in People”, the Chartered Management Institute and the Chartered Institute of Management Accountants.

included, in particular, “social assets”, defined “[...] as resources which promise to provide future social or economic benefits [...]” (Centre for Social & Environmental Accounting Research, 2015), in its balance sheet. These assets was divided into three parts: “staff available within one year”, “staff available after one year” and “training investment”, where “staff available” means available “[...] to provide research and evaluation services [...]” (Centre for Social & Environmental Accounting Research, 2015). We recognize in these social assets some of the elements of the aforementioned economic conceptualisation of HC. The evaluation of these assets was based on their present value, in accordance with the “output- based” approach of HC.

At the end of the 1980s, Robert Gray (1990, 1992, 1994) and Daniel Rubenstein (1992) proposed a “[...] bridging between these emerging green concepts [capital approach of sustainability] and bottom line financial reporting” (Rubenstein, 1992): they adapted the economic and macro interpretation of sustainability in terms of natural capital maintenance to organisations, giving a “natural capital approach” basis to sustainable corporate (financial) accounting. This perspective was then enlarged by the addition of other types of capital to be maintained and managed in a manner similar to the way in which human (and social) capital are maintained and managed (Costanza et al., 2013). For instance, the “Triple Bottom Line” (TBL) model (Elkington, 1997; Gray & Milne, 2004; Norman & MacDonald, 2004; Rambaud & Richard, 2015b; Robins, 2006) relies on three types of capital (financial, human and natural ones) and the “System of Integrated Guidelines for Management” (SIGMA) Project² (The SIGMA Project, 2003) relies on five types of capital (manufacturing, financial, human, social and natural).

One of the most recent attempts to integrate HC in “sustainable” financial accounting can be found in the Integrated Reporting <IR> framework (de Villiers, Rinaldi, & Unerman, 2014; Eccles & Krzus, 2010; International Integrated Reporting Council, 2013), considered as a possible future orientation of corporate reporting. This model relies on six types of capital (financial, man-made, natural, human, social and intellectual). HC is defined as “people’s competencies, capabilities and experience, and their motivations to innovate, including their:

² This sustainability accounting 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.

alignment with and support for an organization's governance framework, risk management approach, and ethical values [;] ability to understand, develop and implement an organization's strategy [;] loyalties and motivations for improving processes, goods and services, including their ability to lead, manage and collaborate" (International Integrated Reporting Council, 2013). Here again it is clear that this definition relies on the economic theory of HC. As far as the assessment of this capital is concerned, *"the IIRC³ makes clear that value creation manifests itself in financial returns to providers of financial capital [...] This approach may do little to alter the perception of value beyond the traditional view that it is the present value of expected future cash flows"* (Sjåfjell & Wiesbrock, 2014). Thus, the "output-based" approach is again chosen as the tenet for HC evaluation. The <IR> perspective on HC is very interesting because, it makes explicit the underlying meaning of HC: we saw that HC is related to productivity and growth, and from a corporate viewpoint, HC is clearly connected to a kind of submission (expressed in particular in the following terms "alignment", "ability to understand, develop and implement organization's strategy", "loyalty") to "standard" corporate goals, *i.e.* maximisation of shareholders value (Flower, 2015; Sjåfjell & Wiesbrock, 2014). Moreover, in the same way the economic theory of HC mixes up capital and asset (HC is an asset), the IIRC does not distinguish capital from resource (International Integrated Reporting Council, 2013). In fact, a prevailing way of tackling the issue of the integration of HC, or related concepts like intellectual capital or social capital, in financial statements, from a normalized (Brännström & Giuliani, 2009) or not⁴ viewpoint, is to consider it as an intangible asset (Bessieux-Ollier & Walliser, 2010). Let us focus on this point.

I.3. Capital, assets and accounting

The confusion between capital and asset (or capital and resource) leads to two interwoven and crucial issues: an accounting one and a "societal" one.

Firstly, from a "traditional" corporate accounting perspective, capital and assets are clearly isolated concepts (Rambaud & Richard, 2015a, 2015b). John Hicks was right when he claimed 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,

³ International Integrated Reporting Council.

⁴ Like in the case of the TBL or the <IR>.

1974). “Traditional” accounting capital is money⁵ that a firm *has to* refund and thus has to maintain. In these conditions, the fundamental mechanism of accounting is simple: some investors bring money to a firm; then this firm must recognize a *liability* towards them to be able to refund them: “*for the purposes of book-keeping treat capital as a liability – treat it just as if it were a debt payable*” (Snailum, 1926); at the same time, this capital is used by the firm to obtain resources, assets, to achieve its goals (and in particular the creation of profit and of goods or services). The double-entry bookkeeping is structured to record this type of operation (Ijiri, 1967, 1975): what is on the right side of balance sheet, the capital invested, must be strictly maintained to be refunded, whereas what is on the left side corresponds to the different *utilisations* of the capital (Riahi-Belkaoui, 2004). Therefore, for instance, a machine is not strictly speaking an asset, but it is the purchase of this machine which is the real asset (Ijiri, 1967, 1975), *i.e.* it is the way money is used which constitutes the asset. So, in “traditional” accounting, capital is a *credit* concept (Nobes, 2014), and capital maintenance is guaranteed at the *level of the firm*.

Now, this viewpoint was challenged by an economic accounting perspective, theorized, in particular, by Irving Fisher (1906, 1930) (Mouck, 1995; Rambaud & Richard, 2015a; Richard, 2014; Tinker, 1980), who concretely implemented and systematized some old ideas, present already at the beginning of the development of capitalism (Nitzan & Bichler, 2009). According to I. Fisher, a capital is a stock of future services. With this conception, the money itself is no longer important in the definition of a capital: everything, *bought or not*, which can provide future services is a capital. The shift from the “money-based” approach of capital to the Fisherian one can be summed up in this way: “*the fact that capital [as money] returns a revenue has led to the conclusion that capital has not only the faculty of maintaining itself, but has actually a power of increase [...] Money is always idle capital*” (Bilgram & Levy, 1914). We have to notice that this perspective is typically related to the aforementioned economic theory of HC. I. Fisher is also famous to have adapted his ideas to accounting and thus, to have completely twisted, reshaped and destroyed “traditional” accounting concepts. The Fisherian accounting theory is firstly based on the neoclassical assumption that firms only exist as a mere tool for the benefit of the stockholders⁶ (Fisher, 1930): firms are deprived of their substance.

⁵ “[...] *the first meaning which every man in business attaches to the expression Capital, is money [...] to bring Capital into a business is to bring money into the concern*” (Macleod, 1856).

⁶ For instance, it is noteworthy that, in (Fisher, 1906), Fisher replaces the term “*Balance Sheet*” by “*Capital account*”.

Secondly, the conjunction of his perspective on firms and on capital, naturally leads him to conceive business capital as a stock of future services generated for the benefit of stockholders⁷. A consequence of this viewpoint is that a capital relies now on what generate these services, *i.e.* on the production process and the goods used in this process; in these conditions, this capital has *no more an intrinsic existence* (as money had). Moreover, whereas in “traditional” accounting, a capital is a credit concept, the Fisherian capital becomes a *debit* concept (Nobes, 2014), related to the assets side on the balance sheet. More precisely, the real capital is the one of the stockholders, *i.e.* a stream of future services or receipts (Hicks, 1939), represented by a set of investments in different firms (through shares for instance). These investments can provide this stream only because there are *things* which are exploited by the firms, in which stockholders invested: these things are corporate assets and constitute a part of the source of this stream. Therefore, in this way, a corporate asset is a part of the stockholders’ capital: here is the starting point of the confusion between assets and capital at the corporate level. The real capital is not really present at this level, it only appears in the personal accounts of the stockholders, as their personal investments. At the corporate level, there are only the components of this capital, the assets. Therefore, corporate double-entry bookkeeping is no longer really necessary (Barker, 2010): only assets management is required, in order to secure the maintenance and the development of the real stockholders’ capital. So, mixing up capital and assets implicitly validate the recognition of this theory, which, since the 1950s (Alexander, 1950), becomes step by step the prevailing one in accounting (Bezemer, 2010; Macintosh, Shearer, Thornton, & Welker, 2000; Rambaud & Richard, 2015a; Richard, 2014): we recognize in this approach the one of the <IR> and of most of the today’s attempts to integrate HC in financial statements. Thus, from this perspective and in accordance with what we showed about the definition of HC given by the IIRC, HC simply corresponds to the recognition that some human characteristics can provide future cash-flows for shareholders, *i.e.* can be seen as a component of the real and only capital.

Then, from a more societal viewpoint, and in line with this analysis, the confusion between capital and assets (or resources) leads to the fact that HC does not mean that human beings are “capital”, or have to be maintained, even protected, for themselves. It only means

⁷ In this way, the Fisherian theory of capital rests upon the *proprietor theory*, which asserts that the firm is not dissociable from the owners/shareholders and that the capital is equal, *by definition*, to the net assets. Moreover, as the firm is a mere object, a set of assets, at the service of the stockholders, it can be transformed into a good to be commodified.

that human beings are mere productive means (*i.e.* assets by definition (Christiaens, 2004; Ijiri, 1967; Pallot, 1992)) to guarantee social growth and/or the development of shareholders' wealth. To illustrate the societal issue raised by HC, Gérard Schoun, for instance, puts two ways to understand the notion of human capital facing each other, summed up by the expression "capital humain versus humain capital" (Schoun, 2014): "human as capital" versus "human is capital". HC from an economic and an economic accounting perspective, is a mere asset, whose existence, in the corporate case, completely depends on its profitability, measured in terms of ROE (Return On Equity). The shift from a conception of workers as expenses (the current normalized way of reporting) to an "idealized" asset viewpoint, corresponds to a shift from a worker-as-a-loss to a worker-as-a-mean: from an accounting perspective, either workers are burdens for shareholders, or are mere objects to develop their wealth. They are never simply human beings who need concerns, they are never really capital. To be very clear, we are not presupposing that workers have not to be productive and should not developed their skills to participate to social and/or corporate goals, we are just claiming that human beings are not *only* productive means and that the goals of society and of firms cannot be only based on growth and shareholders' profitability (Favereau, 2014; Segrestin & Hatchuel, 2012; Sun, Louche, & Pérez, 2011). Therefore it is a fallacy to assimilate human beings and a set of skills and knowledge: a human beings is also a complex entity, with physical, biological, psychological needs and with individual desires. On the one hand, the productivity of a worker is directly associated with the concrete working conditions (Cottini & Lucifora, 2013; Holden et al., 2011; Holden, Scuffham, Hilton, Vecchio, & Whiteford, 2010; Kompier & Cooper, 1999); and on the other, the "investment" realized by a worker in a firm through her whole being (and not just through intangible and immaterial skills) can lead to degradation of her physical and psychological health (Dejours, 2012; International Labour Organization, 2013). Thus, what seems to be really capital, from a corporate and a worker's perspective, is to know precisely how to maintain "good" working conditions and in fact, how to maintain workers-as-real-human-beings in good conditions.

In order to propose a shift from the economic and standard conception of HC to a real conception of human-as-capital, a necessity to design genuine sustainable firms as explained, we now present the "Triple Depreciation Line" (TDL) accounting model, introduced in (Rambaud & Richard, 2015b). This (financial) accounting framework is based on a "traditional" accounting approach: its purpose is to extend the instruments of the protection and the maintenance of the financial capital to other types of resources recognized as being capital, like

workers. Therefore, this model operates a connection, not between capital and assets, but between capital-as-matter-of-concerns and accounting capital. We explain how to apply this model to the HC and then discuss the advantages of this approach. Therefore, the TDL can be seen as a concrete financial accounting proposal to genuinely take into account workers and also, as a new perspective to reframe and reanalyse the notion of HC.

II. The “Triple Depreciation Line” model and the Human Capital

II.1. Introduction to the TDL model

The TDL model is a development and a theoretical extension of the CARE⁸ accounting model, introduced in (Richard, 2012). It is based on three main ideas: (1) financial accounting has to take into account extra-financial types of capital, in a “symmetrical” way; (2) therefore, as explained before, we have to use the traditional instruments of financial capital maintenance to protect the other types of capital, in particular, the planned depreciation of the historical cost accounting; (3) there exists a necessity to make explicit the assumptions on which this model relies, in order to make debates and criticisms possible. The general principle, at the core of the TDL model, is the obligation to maintain financial and extra-financial types of financial, and thus, to put aside enough money to concretely secure this maintenance. As an outcome, it becomes possible to define a global and “sustainable” income, which corresponds to the genuine surplus, which can be consumed without destroying the different types of capital used (Gray, 1992).

The first step in order to implement these ideas and general principles is to clearly define what is a capital from a general viewpoint (and not only from a mere economic viewpoint (Norton, 2005), *i.e.* as a stock of assets). In these conditions, a capital is defined as a resource recognized as having to be maintained over a predetermined period, where a resource is *something* which is used by a firm. The term “used” has no economic, ethical, destructive, *etc. a priori* connotation: it is just an observation of a particular relation between a firm and another entity, which can vary from very aggressive to generous modes (Barry, 1999, 2006; Voorthuis, 2006), but these modes of use depend subsequently on the definition of the concerned capital and its level of maintenance. Therefore, three elements structure this notion of capital: (1) its

⁸ Comptabilité Adaptée au Renouvellement de l’Environnement

ontology (what is this capital? For instance, a stream of future receipts, money, a concrete, material and living organism, a human being, *etc.*); (2) a period to maintain it, according to this ontology (in the extreme, this period can be a-temporal, like in the case of the neoclassical status (Pekkarinen, 1979; Weitzman, 2007)) ; (3) a concern for this maintenance. More explicitly, 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 representatives⁹ or spokespersons of the capital*” (Rambaud & Richard, 2015b). The number and qualities of these spokespersons (Latour, 2004) must be regularly re-assessed to guarantee a non-reductionism and a plurality in the examination of what the concerned capital is. They are not real stakeholders but rather mediators with the concerned capital itself. Indeed, whereas most of the stakeholder theories (Cazal, 2011; Donaldson & Preston, 1995; Freeman, 1984; Garriga & Melé, 2004; Hill & Jones, 1992; Steurer, 2006) focus on the interests on these actors and their more or less democratic management, the “spokespersons-approach” focuses at first on the considered capital itself. The purpose of this perspective is to define a *common* reality (Latour, 2004, 2012b) about this capital in order to be able to subsequently articulate it with the other human and non-human entities of our common world. Indeed, no action is possible if we do not reduce the incommensurability of the different viewpoints involved: generally speaking, this task can be done, for instance, through authoritative institutions, market forces, *a priori* framed economic quantifications (Callon, 1998) or discussions about the interest of actors which have their own partial and fragmented perspectives on reality (like in the case of stakeholder theories). At the end, all these approaches avoid the real debates, those concerning the collective, political (Latour, 2003), dynamic and processual (Callon, Lascoumes, & Barthe, 2009) establishment of a common reality, which could be able to secure sustainable living conditions, and therefore, the debates about what we would absolutely like/need to maintain or not in this common reality (Latour, 2012a). With the concept of spokespersons, the TDL accounting model also captures the fact that the utilization of a capital by a firm implies organisational and societal issues: recognizing a resource as a capital and defining what it is and what its maintenance means are ethical, technical and political debates, where the spokespersons are involved. We stress the

⁹ For instance, independent scientists, local communities, public authorities, NGOs, etc... In the case of a financial capital (money), the representatives are only the investors who possess this money, whereas the ontology of the capital is only the monetary value of this capital. In these conditions, we can measure the leap in terms of the difference in complexity between a financial and an extra-financial type of capital: whereas in the first case, representatives and ontologies are very simple and well-identified, in the second case, spokespersons and ontologies are not only plural but also difficult to identify. In fact, this leap is the central and prevailing issue of sustainability and therefore should also be the central and prevailing issue of sustainable finance.

fact that the complexity of these issues is absolutely not pointless, fruitless or inefficient: they only highlight and faithfully represent the complexity of our world. On the contrary, thinking that is possible to take extra-financial types of capital into account, without tackling these issues is merely rash and allows to arbitrarily create extra-profits at the cost of a livable world: simple rules or procedures are not sufficient for a really complex world (Epstein, 1997).

The second step to define the TDL model is based on six assumptions which give it a precise orientation and structure. The first one (called SA1¹⁰) asserts that at least three types of resources must be recognised as capital (in the sense of being separately and systematically protected): natural, human and financial¹¹. The second axiom (called SA2) claims that to maintain a capital it is necessary to describe it and to apprehend it in the best possible way^{12 13}. This must be done with the recourse of the spokespersons. The third axiom (called AA1¹⁴) states that the use of natural and human types of capital by a firm implies for the firm the obligation to maintain them without any possible *a priori* compensation. This is the translation of the axiom SA1 to the corporate level. A direct consequence of AA1 is the recognition of a liability, which corresponds to the natural and human capital. The next assumption (called AA2) asserts that the repeated use of the natural and human types of capital implies their systematic degradation. More precisely, AA2 states that the common rule is that a repeated use implies a systematic deterioration of the concerned capital; now, if the spokespersons of this capital notice that there is no such a systematic degradation, then the TDL accounting model recognizes a systematic deterioration equals to zero. The role of AA2 is to oblige accounting to connect a particular type of use with a particular type of consumption and therefore, to shift the burden of proof: with the TDL model, it is necessary to prove that a repeated use *does not* imply a systematic degradation. The remaining axioms (called AA3 and AA4) express the fact that the reporting concerning the human and the natural types of capital must be integrated in the traditional financial standards, which means in the traditional balance sheet and the profit and loss statements and that the utilisation of human and natural types of capital are necessary to achieve the goals of the firm.

¹⁰ SA means Social maintenance Assumption.

¹¹ There is, in this way, a strict equality of treatment of all these types of capital.

¹² An implication of this assumption is the obligation of regular re-assessment of these definitions and thus of the different types of representatives concerned.

¹³ This attitude towards the different types of capital is clearly very different from the standard HC theories for instance. In the TDL accounting framework, each capital must be truly understood in its role within the Earth's ecosystem and not as a simple asset for shareholders. Moreover, the presence of the spokespersons implies new types of governance for firms.

¹⁴ AA means Accounting maintenance Assumption.

These assumptions *imply* in particular four main consequences. (1) Repeated uses of the natural and human types of capital must be recorded through the systematic and planned depreciation of the assets, which correspond to the utilisations of these capitals. (2) These types of capital must be valued in terms of money, but this monetisation has nothing to do with a valuation of capital in terms of market prices, shadow prices or discounted values. We prove in fact that the “value” of any accounting capital (*financial or not*) is the sum of the planned costs that are necessary to maintain this capital over the predetermined period of maintenance. In the general case, these costs must be collectively and regularly (re-)assessed by the spokespersons of the concerned types of capitals and the firm, according to the ontology of these types of capital. The computation of these forecasted expenditures is generally approximate and subject to revisions in the case of unexpected events (accidents notably), but at the same time, it allows to cope with genuine uncertainty (Rambaud & Richard, 2015b). Besides, this practice of periodic revisions is a common task of “traditional” accountants. (3) In the TDL framework, “*capital (human and natural) maintenance costs are investments [to compensate the depreciation of the assets corresponding to the utilisations of these capital and therefore to maintain them], while the degradation due to their uses is recorded as a depreciation*” (Rambaud & Richard, 2015b). This means that there are three different depreciation lines (hence the name TDL) in the P&L statement, one for each type of capital. (4) As explained before, the TDL model proposes one and only one global income, which is a single measure of a “sustainable” profit: the concept of profit is totally transformed due to the systematic maintenance of human and natural capital but remains very similar in its form to the traditional one. The TDL’s income, which sums up all of the extensions of the traditional accounting principles to extra-financial types of capital, is structured in the following way:

- + Revenues (sales)
- Expenses for raw material and services
- Expenses for depreciation of financial capital
- Expenses for depreciation of human capital
- Expenses for depreciation of natural capital
- Expenses for taxes
- = Profit of the production team

After this short presentation of the TDL model, let us now apply it to the case of human capital.

II.2. Application of the TDL model to the TDL's Human Capital

According to the TDL framework, a human capital is above all else a human (and not simply skills or knowledge). This human can be used by a firm: it becomes a resource, *i.e.* a worker. But at the same time, SA1 and AA1 imply that she/he is also a capital, it means that she/he has to be “maintained” at a given level over a given period: the activity of the concerned firm cannot be conceptualized without this maintenance. Is it possible to imagine today a firm which would take out a loan of 1000 over ten years, for instance, and which finally would decide to refund only 500 at the end of the tenth year, *even if it paid the loan interests*? In these conditions, this firm would steal the loaner. Therefore, not “maintaining” this worker over a given period should be seen as a theft.

Now, the relevant question is: what must be “maintained” (ontological question) and “over which period” (temporal question)? In order to tackle these two issues, some spokespersons must be recognized: the worker her/himself, some occupational physicians, psychologists and therapists, ergonomists, trade unions, her/his colleagues, her/his friends *etc.* As the number and qualities of these spokespersons have to be regularly re-assessed, completeness is not a desired goal (and in fact cannot exist). It is possible to begin this process with a limited number of “obvious” and “direct” spokespersons, who can use a set of classical and existing indicators, to define the ontology of the concerned worker (Level 1). Then, progressively, some aspects of the working conditions of this worker can appear to be necessary to be discussed, while some spokespersons may be redundant or irrelevant. At the same time, some existing indicators may have to be redesigned and some other indicators may have to be created (Level 2). Some less “direct” spokespersons can also be seen as essential for the process: these spokespersons may represent some more complex aspects of the worker (in relation with extra-organisational issues for instance). Indicators can be replaced by more complex sets of procedures and cosmograms (Tresch, 2005) (Level 3). A platform (material or not, as in the case of an internet platform) can be created in order to allow regular and fluid re-assessments of the ontology of this worker between direct and indirect spokespersons (Level 4). All these levels are simple indications to show how it is concretely possible to implement the TDL model and to increase in complexity and therefore, to cope more and more with the very existence of this worker. We also highlight that what *is* this worker cannot be thought as being substantial: there does not exist a kind of absolute truth to find about her/his existence but at the same time,

it does not mean that this human is a mere fiction: some aspects of her/his existence are just more and less stable over time. That is precisely why it is necessary to regularly re-assess the ontology of this worker, in order to take into account her/his evolution.

The period of maintenance, it means the period at the end of which the spokespersons have to assess if the ontology of this worker is or is not preserved, must be determined together with the determination of the ontology of the worker. We highlight that this period has no reason to be based on the period of employment contract: for instance, in the case of an indefinite employment contract, it would be nonsensical to wait for the retirement of the worker to assess if she/he was not degraded because of her/his working conditions.

Thus, at the end of each round of these collective debates, together with the representatives of the firm which uses the worker, four elements must be determined (and these elements are valid and constitute an instituted benchmark until the next round): (1) the ontology of the worker, (2) the way to maintain her/him (which depends on the way the worker will be used), (3) the period of maintenance, (4) the costs needed to secure this maintenance over the predetermined period and broken down year by year. These costs are no more based on the mere productive capacity of the worker as in the case of the standard economic perspective on HC: they are of course different from the present value of future wages (Becker, 1964; Schultz, 1961; Weisbrod, 1961) but they are also different from the “cost-based” approach of Engel (1883) or Kendrick (1976), because, the issue here, is not to produce efficient human assets but to protect workers, in order them to keep good life conditions, working conditions, and as a consequence, a sustainable productivity. It is possible to decompose these maintenance costs according several categories and criteria. Some of these costs are directly paid to workers, in order to ensure them worthy living conditions. Other costs are related to internal expenditures for (1) better working conditions and (2) high quality training. This last point seems to be common with the investments in HC from a standard economic perspective, but we highlight that, on the one hand, the purpose of this training is not only in connection with the worker productivity but also with her/him personal blossoming; moreover, on the other hand, these costs of training are not reserved to increase *something* but to *maintain* her/his level of qualification. Thus, we stress two crucial points. Firstly, the purpose of the TDL model is not to favour the viewpoint of the worker against the one of the firm or of shareholders, but to create the conditions for a real dialogue and a common and shared reality between these actors (and to avoid oversimplified approaches based for instance on alignments of interests (Hill & Jones,

1992)). In particular, it implies the recognition that a worker cannot be only productive and that it is not possible to separate some aspects of a worker valued by shareholders (like efficiency) and some others valued by the worker her/himself (like personal blossoming). Then, determining what “worthy living conditions”, “better working conditions” or “high quality training” mean is a part of the elucidation (Castoriadis, 1998) of the ontology of the worker. Indeed, in the TDL model, these questions are directly connected to ontological issues in order to highlight that the existence of a worker is dependent on these different questions. For instance, a more ergonomic work station can really affect the very existence of an employee (Marek & Bugajska, 2010): such an employee with or without this station *is* therefore not exactly the same.

Let us suppose now, for instance, that at the beginning of the first year (year N), the spokespersons of the worker, together with the firm, decide that this worker must be re-examined at the end of year N+2 to ascertain whether or not she/he is preserved, according to the collectively determined ontology. The cost schedule corresponding to this maintenance is the following one:

Year 1: 100

Year 2: 200

Year 3: 300

Therefore, the value of the human capital (we suppose that there is only one worker¹⁵) is 600 (=100+200+300). Let us also suppose that the financial capital of this firm is 1000 and that it buys a machine (linearly depreciated over 10 years) with this capital. At the beginning of Year 1, the TDL balance sheet is therefore:

Balance Sheet (TDL) – Beginning of Year 1 ¹⁶			
Machine	1000	Financial Capital	1000
Utilisation(s) of the worker	600	Human Capital	600

¹⁵ Otherwise, it should be needed to open a specific account for each worker and gather all these accounts in the balance sheet in a general account named “human capital”.

¹⁶ All the balance sheets are balanced.

We see that the human capital is on the liabilities side of the balance sheet: the human capital, from a societal viewpoint, is thus also an accounting capital. Moreover, the corresponding asset is the way this capital (the worker) is used. The line between the two types of capital indicates that no *a priori* substitutions between these ones are possible (their natures are strictly different). Let us suppose that during the first year, the net sales of this firm is 500 and that the real costs of the human capital maintenance are 50 (instead of 100 as planned). Moreover, we assume that this worker will be repeatedly used during these three years and that this utilization generates a real degradation. At the end of Year 1, the TDL financial statements become:

Balance Sheet (TDL) – End of Year 1					
Machine	1000	100	900	Financial Capital	1000
Cash			450		
Utilisation(s) of the worker	600	200-50	450	Human Capital	600
				Income	200

P&L statements (TDL) – Year 1				
Financial Depreciation		100	Net Sales	500
Human Depreciation		200		

A “human depreciation” is recorded to take into account the systematic degradation of the worker because of the way she/he is used. This depreciation is equal to 600 (value of the HC) divided by 3 (length of the period of maintenance). At the same time, the real costs of maintenance (50) are considered as investments to “de-depreciate” the use of the HC. The final income is a global one which is based on the preservation of the two types of capital (financial and human).

At the end of Year 1, the spokespersons notice that some key-aspects of the existence of the worker inside the firm was forgotten and/or that her/his initial level of existence (to be maintained) has changed¹⁷. Together with the firm, they decide to keep the same period of

¹⁷ This last situation may happen, for instance, if during the first year, this worker acquires new skills, and that these new skills are considered as being now an integral part of the existence of the worker : therefore, her/his level of existence must be re-determined since the beginning of the period of maintenance.

maintenance, but to change the costs of maintenance for the two remaining years; the new costs¹⁸ schedule is the following one:

Year 1 (ended): 100

Year 2: 400

Year 3: 400

Thus, the new value of the HC is 900 (=100+400+400). The balance sheet at the beginning of Year 2 is (if we suppose that the income is distributed):

Balance Sheet (TDL) – Beginning of Year 2					
Machine	1000	100	900	Financial Capital	1000
Cash			250		
Utilisation(s) of the worker	900	150	750	Human Capital	900

The new “human depreciation” for Year 2 will be equal to $350 = (900^{19} - 200^{20})/2^{21}$. This procedure allows a very flexible and precise way of recording the different re-assessments of the HC.

Finally, at the end of the third year, if the worker is preserved according to the collectively determined ontology, the firm will be able to settle its liability “human capital”, by crediting its asset account “utilisations of the worker”. If necessary, it is possible to record a revenue in the case where the firm would have managed to maintain the HC but with lower costs of maintenance than those planned.

II.3. Some remarks about the application of the TDL model to the human capital

The first consequence of the application of the TDL model to the HC is the disappearance of the concept of wage. Indeed, the only expense associated with a worker is the

¹⁸ If we continue the example introduced in the footnote 17, the costs of maintenance may increase because keeping a higher level of qualification over a given period is more costly.

¹⁹ The new value of the HC.

²⁰ Accumulated depreciation.

²¹ The remaining period of maintenance.

depreciation expense, which secures her/his preservation over a given period. Furthermore, because workers (human capital) are at the same “level” as the financial capital, the profit to distribute is no longer the profit for the shareholders: it is the profit of all suppliers of capital considered as a “team”. As we saw, in the standard economic HC theory, a wage is considered as the remuneration of investments in (economic) HC, and therefore as a return on investments to become more productive. In the TDL model, the remuneration of the productivity of the worker (HC) also exists but is a real one: it is a direct part of the income of the firm that she/he contributed to generate, thanks to her/his skills and knowledge. But at the same time, the fact that she/he invests “her/himself” in this firm, implies a normal protection of this investment. Therefore, the narrative of the TDL model is completely different from the one of the standard HC theory. From the economic HC theory viewpoint, a human being invests money to gain skills and knowledge, for instance. Then this one can get a high qualified job with a high level wage, which compensates her/his initial investment. A great part of the life of this human being is therefore based on the possibility to be a good asset for shareholders who will accept to pay to her/him to, at least, refund her/his initial investment. From the TDL perspective, a human being which works in a firm provides an essential investment, her/himself, that the firm must protect. Then this human capital has a particular yield, which implies a normal profit-sharing.

The second main remark about this application is the possibility to detail into the balance sheet the different generic types of uses of workers. Indeed, in the example presented before, we only showed a single common asset (utilisations of the worker), but concretely, as in the case of financial assets, different types of “human assets” can be reported. Firstly, in accordance with the classification of the financial assets, it is possible to distinguish “repeated uses of HC” (which correspond to financial fixed assets) and “punctual uses of HC” (which corresponds for instance to stocks). Then, in the specific case of HC, another type of categorization may be relevant: “risky uses of HC” and “non-risky uses of HC” (in the case for instance of the mining or transportation sector²²). The first advantage of this type of reporting is to clearly separate and make explicit the different types of costs of maintenance of workers generated by their different types of uses. It is also possible for firms to highlight their specific expenditures for particular types of employment of workers, as these costs are capitalized and treated as investments in specific and dedicated accounts.

²² According to the Bureau of Labor Statistics (United States), in 2013, 655 fatal injuries occurred in the mining sector and 1221 in the transportation sector (Bureau of Labor Statistics, 2015).

The second positive point of this type of reporting concerns one of the cornerstones of the TDL model, expressed in particular in the assumption AA2: the possibility to explicitly differentiate repeated uses from punctual uses, and to connect the first ones to potential systematic degradation of workers, seems to be a crucial point today as far as working conditions are concerned. Indeed, occupational risks are divided in two categories: injuries and diseases. This separation is close to the “punctual/repeated” categorization of uses: the OECD defines an occupational injury as *“any personal injury, disease or death resulting from an occupational accident”* (OECD, 2002) 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”* (OECD, 2002). To give a general idée, in the United States, for instance, in 2008, 5214 workers died from occupational injuries, whereas 49000 deaths are attributed to work-related diseases each year (Levy, Wegman, Baron, & Sokas, 2010). At the same time, *“[...] 3,7 million workers in private industry and 94000 workers in state and local government had a nonfatal occupational injury or illness [...]”* (Levy et al., 2010). Nevertheless, there is a real bias in the taking into account of the occupational diseases, regularly mentioned and documented. As an illustration of this situation, in his report to the Ford Foundation, Nicholas Ashford pointed already in the 1970s that *“official estimates presented by the National Safety Council and the Bureau of Labor Statistics, though clearly inadequate as indices of the true extent of occupational injury, have been even more seriously deficient with the regard to the potentially far more important social problem of occupational illness and disease. In this respect, our data-gathering agencies have mirrored -and reinforced- the pervasive bias toward safety rather than health”* (Ashford, 1976). This review has slowly evolved since the seventies; however, today, *“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). But, at the same time, *“for most developed countries, the most common occupational disorders [including injuries and diseases] are occupational stress and musculoskeletal disorders”* (Aw, Gardiner, & Harrington, 2007). It means that typical illness caused by repeated (over-)uses of workers are becoming the first source of degradations of the human capital in firms, so much so that some western dedicated authorities begin to notice that occupational illness causes more sickness absence than injuries (Irish Health and Safety Authority, 2008). In these conditions, it seems clear that an external reporting which would explicitly include costs associated with the degradation of workers because of repeated uses would be a real societal progress today.

III. Conclusion

In this paper, we proposed to reframe the debate on the concept of Human Capital, with the help of some “traditional” accounting concepts. Whereas the standard and prevailing economic HC theory relies on an assimilation of capital with assets, accounting allows to avoid this confusion. As an outcome, it becomes possible to shift from a perspective where human beings are considered as mere productive means, for the benefit of social growth and the increase of shareholders’ value, to a viewpoint where human beings are viewed as matter of concern for themselves, in their whole materiality, individuality and complexity.

As critique is not sufficient, especially if we want to construct a sustainable world, we introduced the “Triple Depreciation Line” accounting framework (Rambaud & Richard, 2015b), as a concrete and generic example of a real accounting model which can take charge of this last approach on HC. Therefore, through an example, we showed how this model treats this capital and what it can “say” about the different perspectives on HC. Finally, we discussed two main positive consequences of the application of the TDL framework to the HC: the replacement of wages by a depreciation expense and profit-sharing, and the possibility to report different types of uses of HC directly into the balance sheet.

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