Towards a finance that CARES[1] :
From today's Fisherian- (Falsified) Hicksian perspective to a genuine sustainable financial model, designed through accounting principles

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Abstract

Today's sustainable finance mainly relies on the extension of a particular classical capital theory to extra-financial types of capital (in particular human and natural). We call (and justify it) this mainstream theory, the Fisherian-(falsified) Hicksian approach. After a critical analysis of this model, we claim that this way of conceptualising sustainable finance is finally unsustainable. At the same time, we also defend the idea that there is a convergence between ecological-based sustainability (which we can call by definition a genuine sustainability) and the extension of the traditional accounting framework to extra-financial types of capital. Therefore, we propose to structure a sustainable finance from this perspective (which we call CARES, for Capital Approach Resting on Ecological-based Sustainability): after having defined how to operationalise and theorize such a sustainable accounting, thanks to the "Triple Depreciation Line" model (Rambaud & Richard, 2015), we use this model to re-define the notion of free cash-flows to make them "sustainable". We finally discuss the manner they can be used for financing purposes.

Keywords: sustainable finance, social and environmental accounting, sustainability, capital, integrated reporting, free cash-flows

[1] Capital Approach Resting on an Ecological-based Sustainability

I. Introduction

"Sustainable finance" ((Soppe, 2011), (Sun, Louche, & Pérez, 2011), (Haigh, 2012), (Cohen, 2015)) is a relatively new concept (Wilson, 2010) that could be seen as an oxymoron. Indeed, since the 2008 crisis, finance has become a synonym of "short-termism" (Dallas, 2011) (see for instance the 2009 statement of the Aspen Institute for "*overcoming short-termism*" that was signed by, among others, famous CEOs such as Warren Buffett (Aspen Institute, 2009)): in these conditions, how is it possible to articulate "short-termism" with long-term thinking at the core of sustainability? Moreover, as claimed in (Sun et al., 2011), for instance, "*the 2008 global financial crisis has indicated that the conventional dominant paradigm in finance developed since the 1950s is unable to cope with the problems of financial systems, financial markets, and behaviour of financial institutions, and failed to understand the proper role of finance in society and the economic system as a whole*": if today's finance is not even able to adapt with the reality of our socio-systems, how is it possible to safely extend it to much more complex issues, such as those related to sustainability (Wiek & Weber, 2014), which concern future generations and our common world, at a period in which we may have already entered into a new geological era, the Anthropocene[2] ((Crutzen, 2002), (Steffen et al., 2011), (Latour, 2015), (Lewis & Maslin, 2015))? However, at the same time, it is clearly impossible to conceptualise a viable and thus sustainable socio-economic system without financing mechanisms. Thus, finance has a key role to play in a sustainable society, but the challenge for a "sustainable finance" is huge and includes two critical elements: not only tackling the new and complex area of sustainability (Norton, 2005) itself but also doing it without reproducing the same type of thinking which led, in particular, to the 2008 crisis (Schäfer, 2012). Therefore, this challenge relies on the ability of finance to understand its very role in a sustainable socio-economic system and thus in a sustainable society. In this perspective, we argue here that its achievement absolutely cannot stem from the extension of today's prevailing theory of finance (Brealey & Myers, 2003) (and financial accounting (Scott, 2006)), based on what we will call, with subsequent justification, the "Fisher-(falsified) Hicks' model" (FfH model), to

[2] "*The Anthropocene [a concept developed in particular by the Nobel Prize recipient in chemistry, Paul Crutzen, and Eugene Stoermer since the beginning of the 2000s] implies that the human imprint on the global environment is now so large that the Earth has entered a new geological epoch; it is leaving the Holocene, the environment within which human societies themselves have developed. Humanity itself has become a global geophysical force, equal to some of the ''great forces of Nature'' in terms of Earth System functioning […]*" (Steffen et al., 2011). A working group of the "Subcommission of Quaternary Stratigraphy" (SQS), a constituent body of the "International Commission on Stratigraphy" (ICS), a member of the "International Union of Geological Sciences" (IUGS), is studying the official recognition of this new geological era: its decision is expected in 2016.

sustainability issues; rather, it needs to rest upon the extension of "traditional" accounting concepts to these issues.

More precisely, we show that making "sustainable finance" rely on the FfH model can only worsen the unsustainability of our socio-economic system. However, as critiques are insufficient where sustainability is concerned (Latour, 2004b), the purpose of this paper is also to propose a way to build a more sustainable finance, thanks to the redefinition of Free Cash-Flows (FCF) and their utilisations. The guiding line we will follow to reach these goals is the analysis of the concept of capital and some related concepts such as capital maintenance and income. The motivation behind this orientation comes from the fact that the notion of capital and the debates about its maintenance are not only fundamental to understand the structuration, development and implementation of economics, finance and accounting but have also 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 in particular to the work of David Pearce ((Pearce, 1988), (Pearce, Markandya, & Barbier, 1989), (Pearce & Turner, 1990). From this perspective, which we can call the "capital approach" (Ruta & Hamilton, 2014), "*sustainability requires at least a constant stock of natural capital […]*" (Pearce, 1988), where natural capital is defined as "*a stock of natural assets serving economic functions*" (Pearce, 1988). Robert Gray ((Gray, 1990), (Gray, 1992), (Gray, 1994)) and Daniel Rubenstein (Rubenstein, 1992) then 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) relies on three types of capital (financial, human and natural ones), the "System of Integrated Guidelines for Management" (SIGMA) Project[3] (The SIGMA Project, 2003) relies on five types of capital (manufacturing, financial, human, social and natural), and the Integrated Reporting (International Integrated Reporting Council, 2013)

[3] 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.

<IR> framework is based on six types of capital (financial, man-made, natural, human, social and intellectual)[4]. The financial sector has also been strongly influenced by the capital approach: sustainable finance is more and more defined through the investment, management and protection of natural and human types of capital ((Hawken, Lovins, & Lovins, 2010), (Burrett, 2012)). For instance, the Natural Capital Declaration[5] (Natural Capital Declaration, 2012), launched at the United Nations Conference on Sustainable Development (Rio+20) in 2012 and which enjoins financial institutions to "*prepare to help deliver a green economy and a sustainable development financing*", is an initiative "*about the materiality of natural capital to the health of financial institutions*"[6] (Natural Capital Declaration, 2012). This problem of the materiality of the natural capital is also a concern of the so-called "*Is natural capital a material issue?*" report, written by KPMG, Fauna & Flora International and the Association of Chartered Certified Accountants (ACCA) (KPMG, Fauna & Flora International, & Association of Chartered Certified Accountants, 2012), which indicates that "*there is evidence that interest in [natural capital] issues among the traditional users of financial accounts is growing*". Moreover, the international financial reporting standards (IAS/IFRS) include specific standards for natural capital reporting for financial purposes, in particular the IAS 41 standard, dedicated to biological assets (IASB, 2001). In fact, we can note that today's understanding of sustainability mainly rests on financial and extra-financial capital management and maintenance. The capital approach allows economics, finance and accounting to tackle (corporate) sustainability in a quite natural way: because these disciplines are structured around the concept of capital (from a classical viewpoint), if sustainability is seen as requiring financial and extra-financial capital management and maintenance, the extension of classical economic and accounting theories and instruments to non-financial types of capital can achieve sustainability at a social and business level. With this way of thinking, the manner in which we conceptualize financial capital, as well as related concepts such as income, is extended to extra-financial types of capital, and the manner in which these new types of capital are managed and maintained becomes the central issue as soon as sustainability is concerned. This means that, in the capital approach, a given theory of (classical) capital corresponds to a specific conceptualisation of sustainability: thus, finally, the fundamental question is to determine if the

[4] In this paper, we only use two extra-financial types of capital, the human and natural capital, in order to simplify the presentation and because, according to us, it does not make the substance of the capital approach simpler : social and intellectual types of capital can be seen, for instance, as a part of human capital.
[5] Signed by 28 international financial institutions.
[6] "*The NCD [Natural Capital Declaration] [… is] looking to clarify how financial institutions are exposed to material natural capital risks through companies, and to encourage financial institutions to allocate capital to 'natural capital positive' business opportunities*" (Natural Capital Declaration, 2012).

type of sustainability obtained is "really" sustainable (Wilson, 2010). In other ways, on the one hand, the classical economic, financial and accounting *performative* ((Callon, 2007), (Mackenzie, Muniesa, & Siu, 2007), (Ezzamel, 2009)) representations of our socio-economic system rely on particular capital theories and the way the capital is protected and managed: each theory and its specific implementations lead to different types of consequences, wanted or not, foreseeable or not. Now, on the other hand, in the capital approach, the economic, financial and accounting performative *representations* of sustainability rest upon the extension of these classical capital theories to human and natural concerns, and the way to maintain these new types of capital: each classical capital theory corresponds to some particular extra-financial types of capital theories, and the implementation of these last ones lead to different types of outcomes, which can be judged as desirable or not in building a "sustainable" society. Therefore, it is possible to make the challenge of "sustainable finance" formulated above clearer: finance is tackling sustainability by taking into account extra-financial types of capital, but according to the capital theory underlying this approach, the obtained "sustainable finance" may simply reproduce "the same type of thinking which led, in particular, to the 2008 crisis" and would thus be unsustainable.

In this paper, we do not challenge the capital approach, which constitutes a very interesting perspective for grasping sustainability issues, but we assert that the prevailing concept of financial capital, and its related concepts, used in today's finance are not a safe basis to use in defining extra-financial types of capital that are quite capable of achieving a "sustainable" corporate sustainability. We argue that a genuine sustainability (from a capital approach perspective) can only be reached (1) by using the traditional accounting capital theory and (2) by extending it to human and natural types of capital in a way that does not reduce the complexity of our reality: we call this perspective CARES (Capital Approach Resting on Ecological-based Sustainability). Therefore, in line with the conceptualisation of the capital approach of sustainability, in the first part of this paper, we will discuss the concept of capital, and some related concepts, in the "traditional" accounting and in today's finance. To deeply understand the differences between these two perspectives, we will focus on the highlights of the shift from the first to the second perspective. With this aim in mind, we will stress the role of two main actors: Irving Fisher and John Hicks, whose works are not only fundamental to comprehend this shift but are also regularly mobilised in sustainability economics (Nordhaus, 1995). This analysis will notably allow us to call the second perspective the Fisher-(falsified) Hicks model. Then, in a second part, we will present the main issues raised by the utilisation of

the FfH model as far as sustainability is concerned. Finally, we will propose, in a third part, a model of "sustainable free cash-flows", as a starting point for a "genuine sustainable finance". As an answer to criticism concerning the FfH model, these sustainable FCF will be based on the traditional accounting capital theory, extended to ecological concerns. We will also discuss the consequences of this redefinition of FCF for rates of return and the way they can be used in financial management and investments.

II. From a "traditional" accounting to a Fisherian-(falsified) Hicksian conception of capital

II.1. The "traditional" accounting theory

From Luca Pacioli to the development of Historical Cost Accounting (HCA), which took the lead in accounting after the 1870s (Richard, 2012b), the concept of capital in accounting was quite clear and more or less shared with economists[7]: capital was merely money. Thus "*in medieval and early modern times, capital meant money investable or invested in business […] In England in the sixteenth century, the word [capital] retained its Italian and monetary meaning and was used by business firms in their accounting practices*" (Hodgson, 2014). In the same way, in his treatise about "the theory and practice of banking", the economist Henry Dunning Macleod claimed that "*[…] 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). Besides, capital is not only money: it is money 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

[7] Accountants and dominant economists, could have, on the whole, agreed on similar views regarding the determination of income and capital both for structural and valuation problems. As far the structure of the income statement is concerned, the Smithian and, later, the Millian conception of income coincide with that of accountants during the 19th century: profit was considered as the whole income of capitalists – *proprietors* – after deduction from revenues of material, wages, interests on borrowing, depreciation and taxes connected to these revenues (Richard, 2014). As far as the valuation is concerned, the situation was more complex but, on the whole, there was general understanding between accountants and economists. Moreover, Smith, followed by Ricardo and Marx, considered that one of the main characteristics of capital is an accumulation of past costs to be conserved (Smith, 1776). In fact, it has been shown that HCA had substantial common points with the economic conceptions of the Smithian-Ricardian classical and the Marxian schools of economists ((Bryer, 2000), (Chiapello, 2007)).

creation of profit and of goods or services). The double-entry bookkeeping is structured to record this type of operation ((Ijiri, 1967), (Ijiri, 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). So, in "traditional" accounting, capital is a *credit* concept (Nobes, 2014), and capital maintenance is guaranteed at the *level of the firm*.

What is crucial with the conception of capital in traditional accounting is that it is *independent* from the activity of the firm. More precisely, capital has an intrinsic existence that is not conditioned by its utilisation inside the firm: the essence of capital is defined outside the business. If an investor brings 1000 units of money to a firm, the intrinsic existence of her capital is clear: it is precisely these 1000 units, whatever happens during the utilisation of this capital by the firm. Thus, this investor and the firm know precisely what must be refunded to her. Changes of the very nature of capital are, in these conditions, also very clear: they correspond to modifications of the value of money itself, which means inflation or deflation. In particular, that is why inflation is so important in discussions about Historical Cost Accounting.

A direct consequence of this viewpoint on capital is that a firm needs to have, in a symmetric way, a substance independent from the capital: firms and capital are distinguishable entities with intrinsic features. This assumption is at the core of the *entity theory* ((Chatfield, 1977), (Edwards, 1989), (Zambon & Zan, 2000), (Biondi, 2007), (van Mourik, 2010), (Müller, 2013)) of the firm. As explained by Cole, "*when the business is treated as an entity, the accounts of the proprietor, of the partners, of the stockholders, represent in a sense liabilities of the business to the owners at the beginning of any period as if owners were outsiders*" (Cole, 1921): we find again the principle of independence of the capital. The firm-as-an-entity is also a dynamic network of different actors interwoven in a specific area for specific reasons but which remains autonomous from its stakeholders: in particular, owners are not the only prevailing actors.

These two types of independence do not imply that there is no interaction: capital is absolutely vital for a firm and, reciprocally, firms are necessary to develop capital. However, a capital is not *defined* by its utilisation in a given firm and, reciprocally, a firm is not *defined* by the owners of the capital. This perspective allows an approach to the economic system to be based on "*unfolding processes*" (Skaggs, 2003), where "*each transaction of goods and services*

finds its counterpart in a flow of credit/debt instruments, and these financial flows are seen to be integrated (circular): each flow comes from somewhere and goes somewhere. Hence it is possible to represent the economy in a balance sheet manner […]" (Bezemer, 2010). It means that the economic system can be seen as a hydraulic system where motion is made possible by the injection of water (capital), but where this one and the different mechanisms (firms for instance) have their own substances.

Another consequence of this conceptualisation of capital concerns assets: in "traditional" accounting, the recognition of the resources of the firm are based on the manner the capital is used and thus can be consumed in the future. Assets are costs, which means present and future consumptions of capital-as-money (Littleton, 1929). In these conditions, an asset is not directly a thing, even in the case of a tangible asset: a cost *"[…] is the cost of an action and not the cost of a thing at all*" (Bedford, 2014). Thus, for instance, a merchandise and a machine are not directly assets, but it is the actions of acquiring them that are the corresponding assets ((Ijiri, 1967), (Bedford, 2014)). The amalgam between the thing itself and the action of using capital to acquire it makes it possible to show the deep relation between the utilisations of the capital and the means at the disposal of the firm. Planned depreciations of fixed assets are then recorded to guarantee the maintenance not of assets-as-resources, which are mere means dedicated to be replaced by other different types of assets if necessary, and not of assets-as-actions-of-acquiring-resources, but to secure the protection of the capital itself. The fact that planned depreciations are related to assets is a mere accounting mechanism to connect the pace of consumption (degradation) of the capital – *i.e.*, the depreciation – to the way this capital is used – *i.e.*, the asset. This mechanism "*offers the crucial advantage of focusing on systematic capital deterioration caused by the capital's use*" (Rambaud & Richard, 2015). Thus, "traditional" accounting is completely focused on the capital, as an independent entity whose essence must be absolutely maintained. The conceptualisation of assets and the corresponding notion of planned depreciation are developed for this objective.

Because capital has an intrinsic existence, independent from the way it is used, as its utilisations are recorded (as assets) and as these uses show the degradations of the capital embedded in them (in particular through depreciation), it is possible to know periodically what is the deterioration of the capital itself (and to distinguish it from some changes of the very nature of the capital). Maintaining the capital means guaranteeing the integrity of the capital, which implies the necessity of finding specific ways to counterbalance these degradations.

Revenues correspond to the "fresh blood" able to "regenerate" the capital: a part of them will restore the capital, and the remaining part will be seen as a surplus, an income. Here again, the matching principle, which links "*the economic and monetary entity's streams to the reference period*" (Biondi, 2007), is also directly related to the maintenance of the capital, as an independent and "material" entity. Because this maintenance must be effective because of the intrinsic reality of the capital, these revenues must also be actual: if we record unrealised gains, we simply jeopardise the integrity of the capital. Therefore, one of the fundamental roles of "traditional" accounting is to give a piece of information on the realised (or real) income (profit): this is the *principle of realisation,* which states that a profit must be the difference between the cost of obtaining an item of wealth and the price received for a *real* exchange of this item on a market. In these conditions, income is the measure of the *sustainable* surplus, generated by a firm, which does not challenge the essence of what investors brought out and which constitutes a "matter of concern" for them independently of the activity of the firm. As an outcome, the rate of return for owners is a residual concept, a mere consequence of this activity. Capital is invested to get a return, but this one is a mere "hope" which does not condition the reality of the capital itself.

This accounting system centred on the intrinsic essence of the capital and its maintenance is completed by budget accounting to forecast future profits. This particular type of accounting consists of possible scenarios that mark out the activity of the firm during a period. Budget accounting allows a pragmatic discussion on different "corporate realities" but on the same base: the capital-as-money must be protected. Thus, the complexity of the future is not directly crystallized in the ontology of the capital and its management; it is rather tackled in a questioning about the different possibilities of developing a firm and obtaining a surplus, without destroying the material basis that makes this activity possible – the capital-as-money.

We stress that all this conceptualisation of the capital, and the accounting notions and instruments associated, are pragmatic[8] responses to an uncertain, dynamic and complex environment ((Ijiri, 1967), (Biondi, 2007), (Bezemer, 2010)). In such a world, we have to

[8] In the sense of the pragmatic philosophers like Dewey, James or Peirce, where every experience is the result of multiple interactions between an entity and its environment and where the plurality of the modes of existence must be taken into account. This meaning is radically different from the common one, which is merely a synonym of a compliance to prevailing ways of doing and thinking.

determine what we absolutely care about, what constitutes the basis of our survival[9], and then to maintain it, but in a way that is able to cope with the different interactions between it and its environment. In these conditions, to be able to guarantee this survival, we also need this basis to be stable even if it is used: otherwise we would only have sand in our hands, which would slip through our fingers. Thus, the capital-as-money is traditionally this fundamental basis for firms and for the economy. All of the "traditional" accounting mechanisms are organized to guarantee its integrity: they articulate a precise goal, the obligation of capital maintenance and the complexity of the utilisation of this capital (thanks to the particular conception of assets, the method of planned depreciations, the budget accounting, etc.). In addition, the "traditional" accounting makes firms and their stakeholders aware of their direct responsibilities towards the capital; moreover, because the capital maintenance is secured at the corporate level, this means that at the level where the capital is used, firms can adjust their behaviour towards the utilisation of the capital in one way or another if necessary. Finally, the entity theory is also a precondition for Corporate Social Responsibility ((Phillips, 1992), (Coleman, 1994)): without a substantial corporate reality, how is it possible to understand, in the *same movement*, the impacts of all of the actions of a firm? In fact, without a "binder", responsibilities are simply broken up.

This perspective on corporate capital theory and its implications were challenged, at first, at the end of the 19th century by the Neoclassical School, and more precisely, at the beginning of the 20th century by Fisher (Richard, 2014). This author, despite professing to be an admirer of business accountants, nevertheless promoted a new economic theory of accounting that can be characterized "*as the first move toward the colonization of accounting by economists*" (Mouck, 1995) and finally toward the destruction of the essential concepts in accounting described above. His work initiated a deep division between two radically different viewpoints on economics, accounting and finance: this dichotomy, which is at the core of today's economic issues, is also central as far as sustainability is concerned. As we will show, the capital theory developed by Fisher – which is representative of what Hicks calls the *fundist* perspective[10] (Hicks, 1974) – constitutes a basis for a capital approach to sustainability, which

[9] We do not introduce the concept of "needs" because the basis of our survival is much more complex than material or psychic needs.

[10] Hicks explained that economics is based on two main understandings of the notion of capital: "*There are some for whom Real Capital is a Fund – I shall call them Fundists; and there are some for whom it consists of physical goods. […] I shall […] call them Materialists. Anyone, indeed, who uses a Production Function, in which Product is shown as a function of labor, capital and technology, supposed separable, confesses himself to be (at least while he is using it) a Materialist. […]If Production Function is a hallmark of Materialism, the, capital-output ratio is a hallmark of modern Fundism*" (Hicks, 1974). For further details on this distinction, the interested reader can consult (Pekkarinen, 1979). Fisher was typically a leader of fundism (Tarascio, 1993).

appeared to be unsustainable. In these conditions, we need to analyse the differences between the traditional accounting perspective and the one developed by Fisher.

II.2. The Fisherian-(falsified) Hicksian model

II.2.a. The Fisherian theory

II.2.a.1. The structure of the Fisherian capital theory and its implications

It is rare, in the history of economics, to see an economist who openly professes that he finds his inspiration from accountants; even more rare to find someone who attributes to accountants a theory. Fisher is one of these very rare examples. In his masterpiece "The nature of capital and income" (I. Fisher, 1906), he acknowledges the importance of this activity, especially for economics and economists, not only for practical reasons but also for theoretical reasons: "*careful examination shows that accounting is at bottom not a mere makeshift but a complete, consistent, and logical system. When thus conceived and understood it will be seen to be of importance, not alone to the accountant but also to the economist*" (140). This reference to the importance of accounting is not mere rhetoric. Throughout his book, he has a type of obsession to justify his new theory of economics by reference to business accountants. However, we will prove that, as a matter of fact, this justification was based on a radical twist of "traditional" accounting concepts. So what were the main features of the capital theory of Fisher?

First, according to him, all elements of wealth (or capital[11]) have a common point: they *all render services*. He draws the conclusion that wealth can be considered as a *stock of future services*: "*we may picture to ourselves all articles of wealth as having attached to them streams of services stretching out in the future*" (34). In addition, property rights (which mean capital) are "*merely present rights to some of those future services*" (33). With this *unique* and new focus on future services as a basis of definition of capital, Fisher develops a conceptual revolution based on at least two points: (1) Because these services deeply depend on the activity

[11] Despite its importance, due to limited space, we do not intend to comment on the fact that Fisher, contrary to Smith and to the accountants, confuses the concepts of wealth and capital (see for instance (Chambers, 1971) on this issue).

of the firm, the capital is made *dependent* of this activity: capital loses its intrinsic existence, autonomous of its utilisation. The money itself is no longer capital but it is money generating *future* services through a production process that is recognized as a capital. As explained in a clear-sighted way by Bilgram and Levy in 1914, "*the fact that capital 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). Therefore, Fisher translated this viewpoint in business accounting and finance, which corresponds to Marx's formula M-A-M'. Furthermore, with this conception, the money invested itself is no longer important in the definition of a capital: everything, *bought or not*, which can provide future services is a capital. The formula (M)-A-M' is in this way more adapted to this perspective on capital. (2) Because capital is now mainly based on the production process and the goods used in this process, another fundamental shift is performed: whereas in "traditional" accounting a capital is a credit concept, the Fisherian capital becomes a *debit* concept, related to the assets side on the balance sheet. More precisely, the formula (M)-A-M' clearly indicates that a capital is structured by the assets of a firm and not by the investments[12]. However, we stress the fact that "Fisherian" capital is not a set of assets[13] but only a conceptual *thing* that can generate services through assets.

Second, Fisher considers that the real income (profit) from any instrument (asset) is "*the flow of services rendered by that instrument*" (101) during the period of time considered. Thus, one of the particularities of this economist is the confusion between services (consumed) and income, and hence between consumption and income and finally between real income and expected income. Let us consider the following (very simple but illustrative) example.

Example 1.

An entrepreneur E creates a firm F at the beginning of year N, with a personal financial contribution equal to 2000; on the very same day, she buys an asset A for 2000. A is expected to be used regularly during 2 years, its normal life period. At the end of year N, here is the net revenues obtained or expected:

[12] This point of view is of course connected to the Modigliani-Miller theorem (Miller & Modigliani, 1961).
[13] Capital as a *set* of assets is precisely what Hicks calls a materialist approach to capital (Hicks, 1974).

Year N (Period 1)	Year N+1 (Period 2)
Realized Net Revenues	Expected Net Revenues
1210	1331

At the end of year N+1, she finally winds up the business.

According to Fisher, the real (or realized) income of E for period 1 would be 1210, for period 2, 1331: it corresponds to the expected market value of the expected services rendered by the capital. His particular positioning on income was regularly and strongly criticized not only by accountants ((Chambers, 1971), (Lee, 1975a), (Lee, 1975b)) but also by economists ((Lindahl, 1933), (Kaldor, 1955), (Tobin, 1991)). Lindahl explained for instance that "*Irving Fisher's analysis is carried out in masterly fashion, but all his attempts to demonstrate that his concept of income is the usual one and that it is the only logical one must be considered unsatisfactory. In neither popular or scientific terminology are income and consumption equated […]*" (Lindahl, 1933). Defining an income in this way has a very important consequence: the absence of capital maintenance. Indeed, protecting a capital in the sense of Fisher would obviously mean not maintaining the money invested but rather the sequence of future services (by definition). Now, if, at each period, it is possible to distribute the whole services – the whole net revenues in our example – then, at the end of year N+1 for instance, the capital will be reduced to nothing: at that time, the remaining capital will simply generate no future services because there will be no more asset (A is completely out of service).

This restriction of income to the consumption of services stems from the fact that Fisher conceptualizes it from a mere "*psychic*" (165) and individual point of view. In his economic and accounting model, firms do not have a real existence. According to him, "*[…] a corporation as such can have no net income. […It] is a fictitious, not a real, person […] Its stockholders may get income from it, but the corporation itself, considered as a separate person apart from these stockholders, receives none*" (I. Fisher, 1930) Therefore, firms only exist as a mere tool for the benefit of the stockholders[14]. We can see in these orientations his neoclassical influences, which tend to focus the economic theory on investors and consumers, and thus to deprive firms of their substance. Because the capital is only a sequence of future services, generated through assets, the firm is reduced to the management of these assets for the account of the stockholders.

[14] For instance, it is noteworthy that, in (I. Fisher, 1906), Fisher replaces the term "*Balance Sheet*" by "*Capital account*".

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.

Finally, from this definition of capital and income, Fisher naturally conceptualizes the value of wealth or capital (wealth value or capital value) as "*the present worth of the future income from the specified capital*" (202), which means the sum of the discounted future incomes with an interest rate that is a type of minimal rate of profit called by businessmen the "*price of capital*" (191-202). In that case, "*the value of the income stream has heretofore been always reckoned in advance of its occurrence*" (221). One of the main contributions of Fisher to the economic theory was not only the meticulous development of the discounting principle but also his insistence on the universality of this logic (Nitzan & Bichler, 2009): everything that can generate services can be seen as capital and thus be capitalized through the discounting principle. Thus, in our example, if the discounting rate is 10%, the capital value at the beginning of year N is 2200[15]. In this condition, the Fisherian conception of the capital is directly dependent on the incomes – because the services generated by capital are incomes for Fisher, Fisherian capital is a sequence of incomes – and on the rate of return for stockholders, and the capital value is calculated on the basis of an ideal rate of profit. Thus, this rate is fixed ex-ante and calibrates the capital itself. Therefore, this conception of capital is not only obsessively turned toward the future ("*the past have perished*" (22)), but it also freezes this future (Gorman, 1999): future services, future incomes and the expected standardized level of these ones, through the predetermined rate of return, are crystalized ex-ante in this concept of capital. In this perspective, budget accounting is obviously pointless.

II.2.a.2. Fisher and the "traditional accounting"

As explained above, one of the fundamental contributions of Fisher was the introduction of (neoclassical) economic thinking in traditional accounting, in order, in particular, to destroy the accounting capital theory and replace it by the fundist one. The strategy adopted by Fisher was not to simply substitute one theory by another one but to convince economists, business(wo-)men, finance specialists and accountants themselves that traditional accounting

[15] $2200 = 1210/(1+10\%) + 1331/(1+10\%)^2$

practices and concepts have always been based *in fact* on his point of view. This is precisely why it is important to detail the Fisherian approach of capital, not only because he induced a particular way of conceptualizing the corporate capital theory but also because he provided a way of radically discrediting the traditional accounting perspective, which is still topical. Therefore, because of this double strategy, it seems today impossible to think in another manner our financial, economic and accounting approach of sustainability: as we will show, sustainable finance is for instance understood as a mere "normal" and "natural" extension of the Fisherian paradigm for extra-financial capitals.

At first, here, we do not pay particular attention to the will of Fisher to build a bridge between his notion of income as consumption and standard accounting income. Indeed, as explained above, his perspective on profit was considered even by neoclassical economists as very heterodox and quite strange. Thus, a potential relation between his viewpoint and traditional accounting was judged as really "*artificial*" (Frankel, 1952), in particular, because every form of accounting takes great care to differentiate revenues, profits and cash-flows.

What is more interesting, according to us, is his treatment of capital. Indeed, he claimed that "*a merchant's balance sheet is a statement of the prospect of his business. Each item in it represents the discounted value of items which he may expect later to enter in his income account*" (264). At the time when Fisher wrote this statement, the HCA was the standard way of doing accounting. Therefore, according to this manner of conceptualising accounting, at this period, the balance sheet was not as a "*statement of the prospect of business*", which in a way would have rather been the role of budget accounting, but was the statement of realized circulations (Ijiri, 1967) of money, goods and services. In these conditions, the integration of expected services generated by items directly in the balance sheet was simply unthinkable or irrelevant for standard business(wo-)men and even financial specialists[16]. What Fisher called a "*fictitious book value*" (77; 257) represented *de facto* the real and only value of assets: the fictitious value was the discounted value. As Chambers wrote, "*the burden of Fisher's legacy lies today in the proposals under which balance sheet values would be subjective, capitalized valuations of expected incomes from assets*" (Chambers, 1971). However, the confusion brought about by the Fisher analysis can be summed up in this way by one of his

[16] It is only from the 1930s that the fundist way of conceptualising the capital was able to be developed in market analysis, in particular thanks to the evolution of statistical methods, the increasing weight of statisticians and the modification of some economic institutions (Burk, 1992).

contemporaries: "*every banker and every commercial man knows that there is only one kind of capital, and that is money. Every commercial and financial transaction is based on the truth of this proposition, every balance sheet is made out in accordance with this well-established fact; and yet every economist bases his teaching on the hypothesis that capital is not money*" (Mitchell, 1914). We perfectly see here the extraordinary twist of accounting praxis generated by the Fisherian approach (and in general by the (neoclassical) economic perspective). Unfortunately, this argumentative line is today deployed again in sustainability: therefore, for instance and to use the same term of this debate, "every ecologist, every scientist, every organic farmers, every business actor concretely involved in ecology, etc. knows that there is one type of natural capital – even if used by a firm –, and this is a concrete part of the earth's ecosystem in its whole complexity (Norton, 2005)"; and yet, every heir of Fisher bases his teaching on the hypothesis that "each item of natural capital used by a firm, for the account of stockholders, represents the discounted value of items which these ones may expect later to enter in the corporate income account". Moreover, these heirs also claim that their perspective is precisely what the first actors thought to be natural capital.

In addition, to bring together his neoclassical conceptualization of accounting and accounting "in the field", Fisher was also obliged to introduce the notion of "*standardization*" (263) as well as "*earned income*" (234) and "*realized income*" (234). The principle of standardization is based on the distinction between "*actual accounts*" (264) and standard accounts. In "*actual accounts*", the best type to report accounting events according to Fisher, notably from a theoretical point of view, the income to be distributed is the one presented before the value of the *services* recorded during the period considered. This income is supposed to be entirely distributable because Fisher has no capital to conserve systematically, contrary to accountants. Thus, in our example, these Fisherian incomes, recorded in actual accounts, of periods 1 and 2 would be 1210 and 1331. We notice that there is a great variation between these three numbers: generally speaking, the flow of the Fisherian profits and thus of Fisherian dividends is very irregular. Thus, he explains that to smoothen and stabilise this flow, and ideally to adjust it on the "normal" yield of the capital[17] – this means the capital value times the rate of profit –, accountants need to carry out a "standardization" of the incomes. How to guarantee that the standardized income would equal the "normal" yield of the capital? By deducting from the income, the "depreciation" of the capital. Obviously, depreciation must be

[17] As a stream of future services.

understood here in a Fisherian meaning: the difference between the present value of the capital at the beginning and at the end of a given period. The inclusion of a specific and particular capital maintenance issue in the determination of income leads him to bring a concept of realized income and of earned income into opposition. "*The general principle connecting realized and earned income is that they differ by the appreciation or depreciation of capital. It is thus possible to describe earned income as realized income [which is the "real" Fisherian income described before] less depreciation of capital, or else as realized income plus appreciation of capital*" (238). According to Fisher, the accumulation of these depreciations must then be recorded in a "*repair fund*" (259). A direct consequence of this way of doing is the fact that "*[…] the existence of the repair fund to cover depreciation virtually maintains the capital accounts at a constant level […]*" (263) Therefore, from a Fisherian perspective, capital maintenance is absolutely not a fundamental principle that structures the ethics of business but merely a logical implication of the stockholder's desire to make her dividends stable. Moreover, Fisher claims that "*in ordinary business accounting such standardizing is regarded as a sound policy*" (263) and that "*[…] the instinct of the accountant toward standard accounting is [very] strong*" (263): thus, according to him, traditional accounting would be instinctively led by and oriented towards such stabilization of dividends. Moreover, Fisher adds that the reasoning of accountants based on what he calls "standard (or earned) income" is a fallacy and that they should modify their practice to the benefit of his "real" accounting model (254; 264). From a sustainability perspective, and by anticipating our following discussion, this approach can be translated in this way: you *believed* that the maintenance of natural capital as a concrete part of the earth's ecosystem was an *a priori* fundamental principle; no. In fact, the maintenance of the natural capital is only a consequence of the regularity of the dividends of shareholders who invested in natural capital.

At the end, the great strength of the Fisherian rhetoric is its ability to use the confusion of the notion of capital (and its related concepts) to introduce radical shifts into accounting and financial thinking. In addition, we claim that this confusion and this rhetoric is still topical and, in particular, is extended to sustainability issues. However, to deeply understand this today's extension, we need to introduce another actor: John Hicks. Indeed, until the 1950s the status of HCA was well established and backed up by most theoreticians of accounting, such as (Hatfield, 1909), (Paton, 1922), (Littleton, 1928), (Paton & Littleton, 1940) and the profession of accountants. Even before 1929, in a context of quasi absence of regulation of accounting, the Fisherian proposals had not been successful (Dillon, 1984). Then, after the crash, "*Fisher was*

[…] discredited by his 1929 pronouncements and by the failure of a firm he had started" (I. N. Fisher, 1956). The context at that time until the 1950s was to regulate accounting on the basis of HCA principles. However, in the early 1960s, in a context of economic growth, the big crisis was totally forgotten and the way opened by Fisher's ideas began to be popular again in the sphere of some accounting theoreticians. Nevertheless, they did not directly refer to Fisher but rather to Hicks.

II.2.b. The Hicksian theory

Contrary to Fisher, Hicks was not *prima facie* interested in accounting, without being completely unaware of its questionings. He focused his work on mere social and individual economic issues. One of his major books was "Value and Capital" (Hicks, 1939), published thirty-three years after "The Nature of Capital and Income" but which addresses the same issues. In this publication, he notably develops a decisive and remarkable conceptual framework of economic income, in response to controversies on the concept of capital (see for instance (Hicks, 1942)) and in accordance with some key ideas of Fisher, such as the capital theory and the discounting principle (Lee, 1975a). Thus, from a general understanding of what is (or what should be) an income, he presents a very meticulous analysis of the different ways of concretely defining this notion. His global approach of an income relies on the fact that this concept must "*give people an indication of the amount which they can consume without impoverishing themselves*" (172)[18]. So "*following out this idea, it would seem that we ought to define a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning*" (172). We recognize in these lines a very famous and regularly quoted conceptualization of a profit. Now, he suggests that this ideal and general definition cannot be implemented without some approximations. In these conditions, he proposes three types of approximations, which could be concretely used in economics, that he calls Income n° 1, 2 and 3:

[18] From the 2nd edition of 1946 (Publisher: Clarendon Press)

Income n°1	"*the maximum amount which can be spent during a period if there is to be an expectation of maintaining intact the capital value of prospective receipts (in money terms)*" (173)
Income n°2	"*the maximum amount the individual can spend this week, and still expect to be able to spend the same amount in each ensuing week*" (174)
Income n°3	"*the maximum amount of money which the individual can spend this week, and still expect to be able to spend the same amount in real terms in each ensuing week*" (174)

Hicksian incomes

Table 1

Incomes n°2 and 3 focus on the regularly of consumption whereas Income n°1 relies on capital maintenance. That is why some authors, like Nordhaus, relate Income n°3 to the Fisherian conceptualization of income[19] (Nordhaus, 1995). Moreover, it is also possible to build a bridge between the earned income of Fisher and Income n°1. Indeed, Hicks adopts a *fundist* point of view on capital that is in line with the one of Fisher: capital is a stream of future receipts (Hicks, 1939). More precisely, capital is a double sequence: the sequence of future receipts and the sequence of expected rates of return for the investors. For instance, in our example, the initial capital is the sequence (1210, 10%), (1331, 10%), (0, 10%), … Therefore, the capital value is the present value of these future receipts, using the different expected rates of return as discounting rates. The fundamental difference between Hicks and Fisher is that for the former, receipts are not incomes, but maximal possible consumptions. Thus, the Fisherian realized income tends to correspond to the Hicksian receipts and the Fisherian earned income is close to the Hicksian Income n°1[20].

Hicks continues his analysis by distinguishing *ex-ante* (with only forecasts on the economic reality of the period considered and following periods) and *ex-post* (with real information on and only on the period considered) Incomes n°1, 2 and 3. He finally argues that, even if Incomes n°2 and 3 are closer approximations to the central concept of income, Income n°1 remains the most concretely practicable in the real world (176). We do not carry on here a deeper presentation of his theory of income, which is much more complex than the one introduced here, to focus on the utilization of Hicks in accounting. As explained before, from the 1960s, some accountants wanted to step into the breach opened by Fisher. Nevertheless,

[19] In fact, strictly speaking, only the Nordhaus's conception of the Fisherian income is really equivalent to the Hicksian Income n°3.
[20] If we suppose, in the both cases, that the expected rates of return are constant.

notably because of his conception of income and his too visible rejection of the capital maintenance principle, accountants (and in fact also economists) influenced by neoclassical ideas needed another basis to develop a new rigorous theory of accounting. The substantial work of Hicks on income and capital was clearly a good candidate. This approach keeps intact the new conception of capital as a stream of future consumptions and thus the discounting principle, as well as the relations, described before, between income, capital present value and the rate of profit. Furthermore, and this is a crucial point, this perspective proposes an accounting-like conception of capital maintenance: the adoption of the Hicksian Income n°1 allows shifting of the traditional capital maintenance principle from the preservation of money to the preservation of a stream of future receipts. For instance, in our example, the purpose of the entrepreneur E is not to protect her initial monetary investment, 2000, but rather to maintain the following sequence: (1210, 10%), (1331, 10%), (0, 10%), …[21] Thus, at the end of the period 1, her "degraded" capital, which means the sequence of her future receipts from the beginning of period 2, is (1331, 0, 0, …): it is clear that this sequence is different from the original one – the initial capital. Thus, she needs to put aside some money that she *has to invest* elsewhere, at the expected rate of return (10%), to get the same sequence of future receipts from the beginning of period 2. This money is a part of the receipt she obtained during the first period, *i.e.*, 1210. Here, if, at the end of period 1, she reinvests 990 of these 1210, at a rate of 10%, and if she decides now to also invest 121 at the same rate once she arrives at the end of period 2, she can expect to have these total receipts during periods 2 and 3: 1210 (=1331-121) for period 2, and 1331 (=990.(1+10%)² + 121.(1+10%)) for period 3[22]. Therefore, thanks to these decisions and the 990 that she did not consume for her personal pleasure, she is able to maintain the same sequence of future receipts from the beginning of period 2: as an outcome, her Income n°1 for the first period is 220 (=1210-990)[23]. This procedure is of course precisely the mechanism behind the utilisation of the discounted value and the computation of Income n°1. Indeed, 990 is exactly the variation of the capital value between the beginning and the end of period 1. What we want to show here is the foundations of the *fundist* way of thinking regarding an income and the related capital maintenance: the process to preserve this type of capital and to deduct the

[21] Because the rate of return is supposed to be constant in our example (and equal to 10%), we will not mention it in the sequence defining the capital anymore.

[22] Our fictive example is obviously structured to simplify this process, but it correctly illustrates the general mechanism.

[23] For the period 1, the (distributable) Fisherian income is equal to 1210 and the (distributable) accounting income is equal to 210 (=1210-1000), if we use a linear depreciation of the asset A. This last one does not depend on predetermined rates of return, contrary to the Income n°1, and allows capital maintenance, contrary to the Fisherian income.

profit is based only on a system of reinvestments and is disconnected from the initial monetary contribution; furthermore, this maintenance is not guaranteed at the level of the firm (F in our example) but only at the level of the owner/shareholder (E in our example).

It is accepted ((Brief, 1982), (Clarke, 2010)) that the first author who used Hicks in accounting was Alexander (S. S. Alexander, 1950), followed notably by Solomons (Solomons, 1961). This mobilisation of Hicks as a rigorous justification for imposing neoclassical theories, such as present value, in accounting is today a classical method. For instance, the IASB and the FASB (FASB & IASB, 2005) invoked him "*as a foundational authority*" (Jameson, 2005) to defend their conceptions of income.

The problem lies in the fact that Hicks never designed his theory of capital and income to be applied in accounting and finance. First, his different conceptualizations of income were "*immature, tentative, experimental notions*" (Clarke, 2010), which were merely ideal and theoretical reflexions. Therefore, in reaction to (Brief, 1982), where he discovered the (false) utilisation of his notions in accounting, he claimed: "*I had no idea when I wrote that chapter in Value and Capital that it would be taken up by accountants; and The Social Accounts as I first envisaged them, were a pure economist's construction. By the time of the later editions of that book [1952, 1960, and 1971] I had this further experience, and the same applies to all my later writings*" (Brief, 1982). Moreover, the Hicksian capital and income is an *individual* concept and absolutely not a corporate one. Contrary to Fisher, who deliberately mixes up business and shareholder's income, Hicks clearly rejects this point of view and claims that "*it is important, for accounting purposes, to ascertain an income of the business [opposed to an income of the proprietors]*" (Hicks, 1979). The reasons for this distinction stem from the fact that "*it is the current profit which has been earned in the past which is relevant to the future; the capital profit is necessarily irrelevant*" (Hicks, 1979). As a consequence of this positioning, as far as accounting is concerned, Hicks always defended the HCA approach (Brief, 1982). What is remarkable is the fact that Hicks's capital theory is regularly used, notably through secondary references, by financial specialists and mainstream accountants in a way that is the contrary to the ideas of Hicks himself. Therefore, some accountants regularly note this misuse ((Brief, 1982), (Jameson, 2005), (Bromwich, Macve, & Sunder, 2010), (Clarke, 2010)), such as in the case of the FASB and IASB report (FASB & IASB, 2005).

Nevertheless, what we can call now the Fisher – (falsified) Hicks "tradition" tends to impose on accounting, economics and finance some neoclassical notions that strongly challenge the standard ethics of accounting[24].

II.2.c. Comparison between the two frameworks

It is now possible to sum up the two "traditions" presented above in tables 2 and 3. Thanks to these traditions, it will be now possible to understand how sustainability can be conceived as a "natural" extension of these two approaches and to assess the different types of sustainability obtained in this way.

[24] Traditional accounting is finally accused to be irrelevant (despite the point of view of Hicks). Thus, in a series of articles or books, bright financial theoreticians such as (Solomon & Laya, 1967), (Treynord, 1972), (Beaver, 1989) and later (Rappaport, 1986) tried to demonstrate that traditional accounting gives not only no data for forward minded investors but also communicates *false data* to these investors about past performance because the average accounting return on investment (ROI) cannot reproduce the "scientific" results obtained by financiers with their Internal rate of return (IRR). This "terrible" second reproach menaced the very core of accountant's activity by discrediting their methodology. However, the argumentation developed by Solomon and Laya and resumed by Beaver and Rappaport is false. Various authors, chiefly non-American ones, such as ((Kay, 1976), (Peasnell, 1977), (Richard, 1985a), (Richard, 1985b)), have demonstrated that it is possible to aggregate the accounting rates of returns during a period of time to get an average rate of return that will exactly reproduce the IRR. Contrary to (Beaver, 1989), this result is also valid for inflation accounting. In spite of these results, published in the 1980s, the "bias" of accounting returns has been continued to be supposed as true by mainstream financial specialists. This distortion of accounting has allowed them to impose their own model of conception and calculation of the firm's performance. For example, Rappaport, like Beaver, proposes a focus on "*raw data*" or "*more primitive elements*", chiefly expected cash flows (46-48). This will permit calculation and maximisation of the "shareholder value", which means the difference between the corporate value (the sum of future cash flows discounted at a weighted average cost of equity and debt) and debt (51). In the frame of this philosophy of management, the cash flows will "*serve as the foundation for shareholders return from dividends[24] and for share-price appreciation*" (50). This is clearly the Fisherian – (falsified) Hicksian model of income calculation. The argumentation of finance against accounting is the same today. The two main reproaches were repeated without main changes of reasoning in most finance textbooks up to now. Thus, for instance, in the famous world-wide published text book of the Principles of Corporate Finance written by Brealey and Myers (Brealey & Myers, 2003), there is always, edition after edition, the same chapter devoted to the bias of accounting returns with the same reference: the famous article written by Solomon and Laya in 1967. We stress the fact that, with these types of impressive text books, all students in accounting and finance can only be persuaded that "traditional" accounting is useless if not dangerous.

	Traditional Accounting Framework	Fisherian-(falsified) Hicksian model
Capital	Capital is a "substantial" entity (money) Capital is independent from the activity of the firm	Capital is virtual (a stream of future receipts – FCF –) Capital is dependent on the activity of the firm
Capital & income	Capital and income are strictly separated	Capital and income are inter-defined[25]
Capital & Balance Sheet (BS)	Capital is a credit concept Focus on the right-side of the BS	Capital is a debit concept (defined through assets) Focus on the left-side of BS[26]
Capital & Assets	Capital and assets are strictly separated Assets are utilisations of capital	Capital and assets are interdependent Capital is net assets
Capital maintenance	Maintenance of an intrinsic essence of the capital, defined outside the firm Maintenance at the level of the firm Planned depreciations are recorded to guarantee this maintenance	Maintenance, asset management and profit (value) maximisation are inter-defined[27] Maintenance at the level of the owners/shareholders

Comparisons between the traditional accounting framework and the FfH model (1st part)

Table 2

[25] "*In Hicks, the source disappears as a separate entity – capital appears only as the capitalized value of a certain future prospect and income as the standard stream equivalent of that prospect. Capital and income are thus two different ways of expressing the same thing, not two different things*" (Kaldor, 1955), quoted by (Ryan, 2007).

[26] At the corporate level, double-entry bookkeeping is no longer really necessary (Barker, 2010): only assets management is required.

[27] Because capital is defined by future receipts and is conditioned by assets management and by future profits, capital maintenance becomes synonymous with value maximisation. We can note that if V is the initial present value of a *fundist* capital, the expected profit is r.V, where r is the expected rate of return. Thus not only are profit maximisation and value maximisation interchangeable, but also capital maintenance is identical to profit maintenance. We obviously find again the approach of capital maintenance of Fisher: capital maintenance means securing regular dividends.

	Traditional Accounting Framework	Fisherian-(falsified) Hicksian model
"Matter of concerns"	Capital protection	Capital (assets) management and optimisation
Corporate ontology	A firm has a real existence, independent from owners/shareholders Entity Theory	A firms is a commodifiable object at the service of owners/shareholders Proprietary Theory
Income	Based on the principle of realization	Possibility of distributing unrealized future gains[28]
Income purpose	Measuring the available surplus, after securing the integrity of the intrinsic essence of the capital (money)	Optimizing the capital (asset) management
Rates of return	Consequences of the activity of the firm Residual	Capital is dependent on the expected rates of return Determined ex-ante "Causes" of the activity of the firm
Future & Uncertainty	Future is tackled through possible scenarios (budget accounting), based on capital protection Possibility of coping with Knightian uncertainty[29] (F. H. Knight, 2002)	Future and uncertainty are predetermined[30] and crystallized in the concept of capital (Gorman, 1999)
Economic system	Based on the circulation of goods and money Pragmatic conception of prices[31]	Based on dynamic equilibriums ((Weitzman, 2007), (Bezemer, 2010)) Rationalisation of the conception of prices

Comparisons between the traditional accounting framework and the FfH model (2nd part)

Table 3

III. The Fisherian-(falsified) Hicksian model and sustainability

The extension of the FfH model to extra-financial capitals is quite "natural". In fact, with his original approach of capital, Fisher made it possible for the first time to disconnect capital from traditional economic areas. Indeed, in particular, the "traditional" accounting framework was only devoted to financial issues. Because a Fisherian capital is everything

[28] This is a consequence of the *fundist* capital maintenance : in our example, if the first net revenue is equal to 0, then the variation of capital value is -110, therefore the Income n°1 is equal to 0- (-110)=110: an income appears without any activity. On this point, Hicks explained that "*although it remains idle, nevertheless the [capital] yields a net income […] it is thus not surprising that the business man should pay little attention to such 'income' […]*" (Hicks, 1942). Nevertheless, since this point was made, business(wo-)men and financial specialists have been convinced that this type of income could be interesting.

[29] Beyond probabilities, statistics and risk management, the genuine uncertainty of our world can only be grasped through processual and collective decisions (Callon et al., 2009), as in the case of budget accounting.

[30] Through modelling and risk management.

[31] Prices depend on objective elements (e.g. quantities and nature of goods) and subjective elements (e.g. institutions, norms) (Biondi, 2007).

bought or not that is able to generate future services, a (corporate) natural (resp. human) capital is in this way a *thing* that is able to provide future receipts to shareholders, through specific utilisations of natural (resp. human) resources[32], and which is therefore evaluated with present value. This perspective is in accordance with the capitalist spirit, where all of the facets of our world are subjects to quantification and automatic comparability (Nitzan & Bichler, 2009). This conceptualisation of extra-financial types of capital is a prevailing one today[33] (Richard, 2012a). For instance, the "Wealth Accounting and the Valuation of Ecosystems Services" (WAVES) initiative (World Bank, 2015) of the World Bank as well as its analysis of the total (financial and extra-financial) wealth of nations (World Bank, 2006) is devoted to "*capture the benefits of social (e.g., human health and nutrition benefits) and ecological (e.g., climate regulation) factors [which constitutes the different types of extra-financial capital for this institution] and compute a value in terms of their net present value*" (Z. Knight, Robins, & Chan, 2013)[34]. At a corporate level, one of the first attempts to integrate extra-financial types of capital in financial reporting was the one used by the Clark C. Abt firm (Estes, 1976), which used the present valuation method. Other types of theoretical and applied reporting proposals have since been suggested, and, generally speaking, they had recourse to this viewpoint on natural and human capital ((Rubenstein, 1992), (Thornton, 2013)). Two typical illustrations of this method can be found in the examples of the IAS 41 standard (IASB, 2001) and the Integrated Reporting <IR> project (IIRC Council, 2013).

The first example is a standard developed by the IASB[35] to report on biological assets – a part of the natural capital – which means living plants and animals used for agricultural activities. Here, this natural capital is assessed and measured at fair value less costs to sell. In

[32] We highlight that this approach is different from the extension of *materialist* capital (Hicks, 1974) to sustainability issues ((Pearce, 1988), (Ruta & Hamilton, 2014)). From a materialist perspective, a natural capital, for instance, is a *set* of different natural goods such that each of these goods can provide "static" utility. The evaluation of such a natural capital rests upon the assessment of the Willingness To Pay – WTP – (or To Accept – WTA) of consumers for these natural goods. These WTP or WTA are evaluated directly on markets or indirectly through hedonic prices, travel costs, contingent valuations, etc. (Pearce et al., 1989). This article is not the place to discuss the difference between this viewpoint and the *fundist* one of the FfH "tradition". The interested reader can consult (Kyriakou, 1995) or (Serafy, 2013) for more details. We only stress the fact that the Fisherian approach allows one to escape the issue of assessment of WTP or WTA of the natural goods: this problem is replaced by the evaluation of the future services generated by the whole *fundist* natural capital, where there generally exists a market to reveal the value of these services.

[33] For instance, as explained by the Sustainable Development Director of Nike in 2011, "*the time is fast approaching when we will jettison the language of sustainability, and simply talk about value creation; NPV [net present value], ROIC [return on invested capital], market share, innovation portfolios and shareholder returns*" (Elkington, 2011).

[34] This quotation is extracted from a recent report of HSBC on the natural capital issue.

[35] IAS 41 was originally issued in December 2000 and first applied to annual periods beginning on or after 1 January 2003.

the case of these particular assets, this fair value must generally be assessed by using the present value method ((Elad, 2007), (Herbohn & Herbohn, 2006)). Moreover, because an asset, according to the IASB, is defined as a "*resource controlled by the entity [organization] as a result of past events and from which future economic benefits are expected to flow to the entity*" (IASB, 2010), we find again the FfH conceptualisation of the natural capital as a stream of future receipts, evaluated at its total present value. The second example, Integrated Reporting <IR>, has tended to become a reference in terms of comprehensive reporting for corporate financial and management purposes. Sustainable finance is therefore more and more concerned by the development of <IR> ((McCluskey, 2012), (Ronquest, 2012), (Schäfer, 2012)). This case is interesting because it is in accordance with a general rhetoric to introduce Fisherian extra-financial types of capital, which we can also notice for instance in the Natural Capital Declaration (Natural Capital Declaration, 2012): on the one hand, the <IR> framework does not clarify its very position concerning the precise definition and the assessment of the different extra-financial types of capital that it introduces (D. Alexander, Aprile, & Magnaghi, 2014), but, finally, on the other hand, « *the IIRC [International Integrated Reporting Council] 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). Therefore, the rhetoric of natural (and human) capital, which is, generally, speaking presented as a "good" thing and as only based on the preservation of our planet, may be finally a "Trojan horse" to introduce a mere FfH model (Sullivan, 2014).

What are the main consequences of the extension of the FfH model to extra-financial types of capital and thus of "FfH sustainability"? The first consequence, from a conceptual point of view, is an extension of the entire second columns of tables 2 and 3 to natural and human issues. Therefore, if we only consider the case of the natural capital (*mutatis mutandis*, the situation is the same, roughly speaking, for the "human capital"), we can establish the following points:

	Fisherian-(falsified) Hicksian model	Consequences for the natural capital
Capital	Capital is virtual (a stream of future receipts) Capital is dependent on the activity of the firm	Natural capital is a virtual entity: parts of the earth's ecosystem are reduced to streams of future receipts, generated through their corporate utilisation (see part III.2) Natural capital is not genuinely a different type of capital: it is only the natural manifestation of the concept of capital[36]
Capital & income	Capital and income are inter-defined	The definition of Natural capital relies on the future profits it can generate
Capital & Balance Sheet (BS)	Capital is a debit concept (defined through assets) Focus on the left-side of BS	Natural capital is a debit concept (as in the case of IAS 41) Natural capital and natural assets are mixed up[37] Because assets are mere means ((Ijiri, 1967), (Pallot, 1992)), natural capital makes the non-humans mere means (opportunities) for shareholders' ends[38]
Capital & Assets	Capital and assets are interdependent Capital is net assets	
Capital maintenance	Maintenance, asset management and profit (value) maximisation are inter-defined Maintenance at the level of the owners/shareholders	Because there exists only one real type of capital (see the first row), natural assets are substitutable with other types of assets: this conception of natural capital is a weak sustainability conception (Neumayer, 1999) Natural capital maintenance means natural assets (resources) management and optimisation ((Norton, 2005), (Conrad, 2010), (Dedeurwaerdere, 2014)) and maintenance of the *whole* capital of the shareholders

Natural capital in the FfH model (1st part)

Table 4

[36] More precisely, the Fisherian concept of natural capital is not a real extension of the classical Fisherian capital : because this last notion can by definition encompass everything type of thing, introducing a Fisherian natural capital means only noticing and encouraging the fact that nature can generate future services. Thus, with this method, capital is not extended to take into account nature; rather, nature is reduced to fit the Fisherian notion of capital.

[37] For instance, the <IR> does not distinguish between "capital" and "resource" (D. Alexander et al., 2014).

[38] For instance, the "Dow Jones Sustainability Indices" defines corporate sustainability as a "*business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments*" (Dow Jones Sustainability Indices, 2013). In the same way, the Sustainable Development of Nike in 2011, claimed that "*we have long said that things we have taken for free will become the new gold, water, waste, carbon. […] The weather is not waiting to be regulated. We believe we have entered the era of climate adaptation, where we are no longer contemplating the potential but beginning to grapple with the consequences. […] When we talk about sustainability without the context of value creation [for shareholders] we diminish the potential and the opportunity and the speed with which the transition will happen. How do we turn sustainability into a 'pull' function, not a 'push' function, within a corporation? The answer, lies in viewing sustainability as a strategic prism through which to view the resiliency, future growth trajectory and value creation potential of a company*" (Elkington, 2011).

	Fisherian-(falsified) Hicksian model	Consequences for the natural capital
"Matter of concerns"	Capital (assets) management and optimisation	*Whole* capital (natural plus non-natural) management and optimisation
Corporate ontology	A firm is a commodifiable object at the service of owners/shareholders Proprietary Theory	A firm, as a set of assets (natural and non-natural) is a commodifiable object Natural capital increases the market value of the firm
Income	Possibility to distribute unrealized future gains	Unrealized future gains are increased with the natural capital (see part III.1)
Income purpose	Optimizing the capital (asset) management	Optimizing the natural resources management, which leads to eventual destruction of parts of Earth's ecosystem (see part III.2) In a genuine Fisherian orientation, the *whole* income (natural plus non-natural) maintenance can be seen as the only purpose of sustainability[39]
Rates of return	Capital is dependent on the expected rates of return Determined ex-ante "Causes" of the activity of the firm	Natural capital is conditioned by predetermined rates of return (see part III.2)
Future & Uncertainty	Future and uncertainty are predetermined and crystallized in the concept of capital (Gorman, 1999)	Natural resource management is based on strong hypothesis about the behaviour of non-humans (Latour, 1998)[40]
Economic system	Based on dynamic equilibriums ((Weitzman, 2007), (Bezemer, 2010)) Rationalisation of the conception of prices	Natural capital must be assessed at a dynamic optimal value, its present value ((Perman, Ma, McGilray, & Common, 2003), (Weitzman, 2007), (Conrad, 2010))

Natural capital in the FfH model (2nd part)

Table 5

[39] Indeed, Nordhaus revived the concept of Fisherian income in environmental economics ((Nordhaus, 1994), (Nordhaus, 1995), (Nordhaus, 2000), (Nordhaus, 2005)), thanks to a shift in meaning, and he opposed it to what he called the Hicksian income (Income n°1). He uses the income-as-consumption approach of Fisher to define a notion of (Fisherian) "sustainable income" (Nordhaus, 1995) which is "*the maximum amount that a nation can consume while ensuring that members of all current and future generations can have expected lifetime consumption or utility that is at least as high as current consumption or utility. Put simply, Fisherian income is the maximum sustainable level of consumption*" (Nordhaus, 2000). This type of income is today an important concept in mainstream sustainability theories ((Cairns, 2000), (Michael Harris, 2001), (M. Harris, 2007), (Lawn, 2008), (Lawn, 2009)). However, whereas Fisher only entangles income and consumption, Nordhaus adds a normative (and essential) component: the sustainability of this consumption. Therefore, this type of income is rather a Hicksian Income n°3. In these conditions, this "rehabilitation" in sustainable development of the Fisherian theory of income is clearly questionable. This perspective has nevertheless an implication in line with the Fisher's ideas: capital maintenance is abandoned for the benefit of a focus on future services.

[40] Our world is understood as being predictable, in a way or another, over great periods ((Cartwright, 1994), (Latour, 2004a), (Callon et al., 2009), (Goodchild, 2009)): more precisely, on the one hand, *" [even if] mainstream economists […] recognize uncertainties and surprises […, t]hey start, however, with the intuition that for almost all individuals of any species, nature is quite predictable […; whereas, on the other hand,] ecological economists promote their own linear or Newtonian models, relating natural and man-made capital, throughput and ecological stress, and economic growth and net primary production co-option*" (Sagoff, 1995). Risk management, based on mathematical models, tends to capture, forecast and optimise non-humans behaviour, for the ends of shareholders (KPMG et al., 2012).

These two tables give a general summary of the FfH capital approach of sustainability. Let us now focus on its concrete consequences.

III.1. Financial and social issues

The first implication of this type of sustainability consists in the extension of the well-known issue of distribution of unrealized gains (Rashad Abdel-Khalik, 2010) to natural and human capital. Let us consider first a classical situation, the one of our example, where we suppose that the net revenues of the first period is 0 and the asset's price is 1000: as noticed previously, an income of 110 is recorded but without any activity because of a mere variation of the discounting value of the capital of E invested in F. If we follow the genuine Hicksian theory, this income would be only an ideal "shareholder's income", not the real corporate income, which should be the HCA income, *i.e.*, -500 (=0-500), with a linear depreciation. Thus, in these conditions, if E wants to consume this "shareholder's income", she needs to obtain a loan, to buy other shares or to sell a part of her shares. In the case where she decides to obtain a loan or to buy shares, she obviously hopes that the real cash-flow of period 2 will be equal to the expected one and that the normal rate of profit will not decrease (otherwise the depreciation of her capital will increase). In one way or another, what is important here is the fact that the decisions of E concerning her "shareholder's income" do not affect the firm itself. This approach secures not only the very existence of the firm but also the status of its employees and the stability as well as a certain level of prudence (not sufficient in general) concerning its future management of human beings and natural resources. However, in the FfH model, this income is the normal distributable one. Thus, its distribution obliges, in particular, firms to increase their debts for reasons not connected to their activities. This situation may impose a great risk of bankruptcy on the business, its employees and its stakeholders[41]. Moreover, the recognition of these virtual gains or losses "*increases the volatility of reported income*" (Herbohn & Herbohn, 2006).

[41] Furthermore, the lack of self-financing drives the firms to seek debt financing all the more than finance specialists encourage the use of the famous leverage effect. This evolution towards financing by debt is also a symptom of the sickness of today's financial capitalism and a general factor of economic crises, notably that of 2008 ((Lordon, 2000), (Stiglitz, 2010), (Jorion, 2011)).

The introduction of other types of capital greatly increases these risks. Here again, the example of the IAS 41 is very illustrative. Indeed, it is currently the main example of the official application of the FfH model to natural capital in financial accounting and financing decisions. The following graphics (Fig. 1) shows the breadth of unrealized gains that stem from the use of this reporting standard.

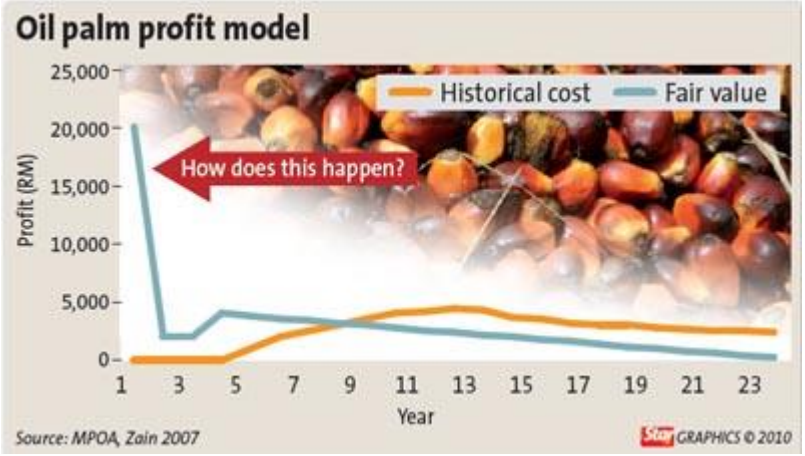

Fig. 1

Source: (Hanim, 2010)[42]

This figure addresses the implementation of IAS 41 in Malaysia in oil palm plantations. We clearly see the phenomenon described above: the appearance of huge unrealized shareholder's incomes at the beginning of the plantation exploitation, at the time when these plantations are not mature enough to guarantee real profits. In these conditions, there is a total disconnection between the material reality of the creation of incomes and the desires of quick profits (Macintosh, Shearer, Thornton, & Welker, 2000), whereas the HCA respects this reality. This case was deeply studied by Suzuki (Suzuki, 2012), notably from interviews realized in 2010. He concluded that "*IAS 41 […] negatively affects the sustainable development of the most important industry [palm oil] in the [South East Asian]*". Previously, in 2010, Suzuki and Jaypal submitted a report to the Institute of Chartered Accountants of India (ICAI) about the socio-economic impacts of IFRS on wider groups of stakeholders in India (Suzuki & Jaypal, 2010). In all of these studies, they severely criticized the implementation of IAS 41. From several interviews on the impacts of this standard, they concluded that "*96% of the respondents believe that IAS 41 was significantly damaging to the sustainable development of the plantation industries*" (Hanim, 2010). Because of the FfH conception of capital incorporated in this

[42] MPOA : Malaysian Palm Oil Association

standard, this one leads to an economic (Herbohn & Herbohn, 2006) and social unsustainability, in line with the type of financial crisis and scandals we experienced since the beginning of this century. Thus, in 2010, the CEO of MPOA[43] claimed, regarding IAS 41: "*this accounting makes our industry unsustainable. […] The consequences are like what happened to Enron"* (Suzuki, 2012). The Malaysian Minister of Plantation Industries and Commodities also used this comparison: "*This is Enron Accounting for Agriculture… The only difference is that it was a scandal at that time; now it is mandatory*" (Suzuki, 2012).

Moreover, through an analysis of the links between fair trade and IAS 41, (Elad, 2007) noted that this standard systematically reduces the complexity of the socio-environmental relations, which occurred and are necessary in production processes, to a pure market valuation for shareholders' benefits. As a consequence, IAS 41 "*aggravated social conflict in some national settings*" (Elad, 2007), in particular in developing countries because of an emphasis of the investors' perspective at the expense of the perspective of other stakeholders and did "*not faithfully represent[s] the value of natural resources, thus helping to facilitate the expropriation of the wealth of some less developed countries where [IAS 41] were instituted under the auspices of the World Bank*" (Elad, 2007). This neo-colonization of developing countries thanks to the principles behind IAS 41 are well summarized by the Indonesian Deputy Minister of State Owned Enterprises[44], who explained, regarding figure 1: "*Let's look at the main issue over a long period of time – take the case of Indonesian development. In the 1800s our champion was coffee, until it declined in the early 1900s; it was replaced by sugar and the sugar era ended in the 1930s… And then sugar was replaced by rubber, which declined in the 60s. It was replaced by oil and forestry, until they declined in the 80s. … and now forestry and oil have been replaced by palm oil… Now, the question is to what extent the palm oil will be sustainable. … there are issues with exploitation – the issue of the Post-Colonial Economy – particularly if the profits are distributed to the Western investors in the first years*" (Suzuki, 2012).

Therefore, "FfH sustainability" tends to increase at the same time the weight of shareholders and of unrealized gains. The example of IAS 41 gives an illustrative example of what is presented in the tables 4 and 5: because FfH natural (resp. human) capital is, by definition, only based on natural resource management to optimize the shareholders' corporate

[43] Interview with Mr. Salleh, KL, Malaysia, 24/06/2010.
[44] Interview with Pakhpahan, Deputy Minister of State Owned Enterprises, Jakarta, Indonesia, 29/06/2010.

value, this type of sustainability and of sustainable finance leads to a *radical* focus on these stakeholders. Moreover, because the human and natural entities of our world that could be (over-)exploited constitutes an extraordinary stock, the recognition of these sources of potential (over-)profits leads to much higher shareholders' value than the value generated by classical exploitations: this is the precise meaning of the aforementioned quotation of the Sustainable Development director of Nike in 2011 ("*we have long said that things we have taken for free will become the new gold, water, waste, carbon*" (Elkington, 2011)). Therefore, we can notice the unsustainability of such a sustainability in terms of economic issues (because of an increase of potential unrealized gains recorded as distributable income) and social issues (because of the implications of the risks for business, employees, and stakeholders, generated by these distributions of unrealized gains; and the extension of the stranglehold of Western investors and institutions on low income countries[45]).

III.2. Natural and human issues

Beside these particular types of issues, the main consequence, according to us, of the "FfH sustainability" concerns the conception of the natural (resp. human) capital itself. Indeed, this perspective is based on a strong disconnection with reality. Here, we do not use this last term in a realist, constructivist, materialist or even phenomenological meaning but in its immanent and pragmatic sense: reality is never outside of an ideal inside – a "*brain-in-a-vat*" (Latour, 1999b) – which dominates or is dominated by this reality; reality is not subjective or objective but is rather fundamentally a full life experiment (Debaise, 2007), which is always a coexistence with a multitude of other entities, human or not, in a common world (Latour, 2004a). This point is absolutely crucial in particular as far as sustainability is concerned: we are not reasoning on disconnected and ideal external issues, but we *live inside* these issues. Therefore, a forest, an ecosystem, an employee, etc. are never distant matters of fact but are rather always close matters of concerns (Latour, 2004a): tackling sustainability outside this perspective is only discoursing on a virtual image of sustainability in an ideal and non-existing world.

In these conditions, let us consider a particular forest or a specific biodiversity, for instance. FfH sustainability transforms them into factors of the natural capital. Therefore, *this*

[45] These countries constitute in particular a huge stock of natural and human entities, "ready" for a transformation into Fisherian natural and human capitals, through mainly Western investments.

forest-as-a-Fisherian-capital and *this* biodiversity-as-a-Fisherian-capital *are* streams of future receipts. As shown in tables 4 and 5, this means that these two entities are reduced to virtual entities whose existence relies on the activity of the firm that exploits them, on the future shareholders' profits and on ideal ex-ante rates of return. Let us consider the following metaphor to illustrate this situation. This forest with its whole biodiversity can be seen as a landscape of which a photographer may desire to take a picture. In the same way that a map is not the territory, this picture is obviously not this landscape and even less this forest or this biodiversity. It is also clear that without these particular entities, the photo would not have been the same, and thus, that these ones (co-)"generate" this photo. Therefore, there is a difference between a forest or a biodiversity that allows the production of this picture that is valued by the photographer, and this *real* forest and this *real* biodiversity. Moreover, the fact that this photography lover enjoys these entities in particular through her pictures does not imply that these entities are designed to be only supports for images. More generally, our common world is not designed for humans and, by way of consequence, not for shareholders; however, at the same time, fortunately, it allows the ability to live inside and even to generate surplus. The recognition of this last observation may lead to a confusion between an entity in its whole reality and a particular utilisation of it as well as suppositions about the implications of this use: as explained previously, the conception of a capital-as-a-fund rests upon the fact that because money invested can *in general* generate money if *correctly* managed, a *black box* containing specific structures of management, ex-ante rates of return and expected future profits is created to replace the money itself and is therefore called capital. In these conditions, if we extend this way of thinking to extra-financial issues, as a forest or its biodiversity can generate, in general and in specific conditions, valued pictures, is it a reason to consider that the existence of these entities is precisely only the ability to generate expected photos? In addition, in the same manner, is it possible to sort the wheat (the beautiful aspect of the landscape) from what is thought by the photographer as being the chaff (the "part" of this forest and biodiversity that has no role for the picture)?

If we accept the fact that a Fisherian natural (resp. human) capital *is not* the real entity that it is supposed to represent, it is possible to argue that because this natural (resp. human) capital depends on these real natural (resp. human) entities, all in all, the management of the Fisherian natural (resp. human) capital can nevertheless lead to a "good" and sustainable "management" of the concerned real entities. First, we have to notice that the integration of these entities is purely at the margin; we can adapt the remark of Latour concerning the

sociology of scientific knowledge in our context: "*if you make a list of all the roles that things […] play in [FfH model]'s narratives, you will be struck by the fact that they don't do very much. […] They are like hosts at a party where all the food has been brought by the [shareholders…] to stand up as tokens, but they are not there to eat and certainly not to bring their own doggy bags*" (Latour, 1999a). In fact, real entities are only traces (Favereau, 2011) in the FfH sustainability, mere ghosts. In addition, the animation of these spectres is done through simple representations and can be inserted in equations. From a mere stream of receipts, this forest and this biodiversity now *become* a small set of limited quantitative indicators (Fromm, 2000), governed by predictable laws, whose purpose is to guarantee the optimisation of the profit generated by these entities: we substitute a picture by another one. In addition, the belief that an increase in the number of indicators and in the development of more advanced models can lead to a full capture of the real entity is similar to the belief that an increase of the number of pixels can transform the picture of a forest into this forest. Now, to be clear, we absolutely do not demand abandoning modelling and recourse to indicators or science. However, the central question is "what is the purpose?" There is a strong difference between finding ways to regularly and permanently explore our world and cope with its complexity, by using science and models, and reconstructing an artificial and manageable reality, able to generate the expected benefits at the predetermined rate[46].

However, it remains possible to assert that this drastic reduction of reality can achieve a *genuine* sustainability *at the end*. In this case, it would be extraordinary luck that by managing very simple images of our world[47] only for profit generation, *at the end*, we would be able to perform actions that do not affect the part of our reality that is outside the picture and which constitutes the substance of our reality. In other terms, how would it be possible to perform real actions on the real forest, planned and thought only through its pictures (even with a multitude of pixels) as well as the esthetical values of these photos for the photographer, and finally to hope that these actions will not dramatically affect both the forest and the future pictures? Of course, in our *reality*, this fiction is out of our possibilities ((Latour, 1998), (Forsyth, 2004), (Dedeurwaerdere, 2014)). Thus, Pearce in 1976 (Pearce, 1976) demonstrated for instance that even if we internalize externalities and even if we do that in a dynamic way, it is not possible

[46] In particular, " *[…] there is a fundamental difference between the view that quantitative prediction is* difficult *and data intensive ('we need more research') and the view that nature is* not *equilibrium centred and* inherently *unpredictable*" (Berkes et al., 2002).
[47] In the case of biodiversity, for instance, "*[this one] is not the same as its measure. Nor is biodiversity one and the same as an index that purports to summarize, represent, quantify, or rank it*" (Maier, 2012).

to avoid the destruction of ecosystems because, in particular, of the difficulty of taking into account the complexity of ecological thresholds (Perrings & Pearce, 1994) in neoclassical economics in general, due to the type of models used and the optimisation principle ((Godard, 2004), (Richard, 2012a)). Moreover, management of renewable resources based on the discounting principle can lead either to particular sustained yields or a destruction of the resource ((Clark, 1971), (Conrad, 2010)). These two possibilities depend on over-simplified curves representing the resource evolution[48] and also on the relation between the discounting rate and the initial rate of growth (or renewal) of the resource (i.e., the rate of growth of a small quantity of this resource). Therefore, roughly speaking, if the discounting rate corresponding to expected rates of return is greater than this initial rate of growth, it becomes optimal to destroy at term this resource. Thus, we either reach a level of a sustained yield that can lead to an "*ecosystem unsustainability*" (Lugo, 1995) or a mere destruction of the resource without any real thinking regarding the destabilisation generated by this disappearance (Berkes, Colding, & Folke, 2002) and the ethical implication of this action (Callicott, 2013).

Therefore, two fundamental issues are at the core of the Fisherian natural (resp. human) capital: the fact that the real entities are considered at the margin and their ontology, reduced to predictable and quantified "images"; and the fact that these entities exist only because of the profit (in general welfare) that they can generate. Behind the first assumption, there is a strong hypothesis about our reality that ecological studies systematically contradict ((Berkes et al., 2002), (Dedeurwaerdere, 2014)): indeed, real things always exceed, even just a bit, what we think, what we do, what we desire (Latour, 1998), and from this overflowing stems not only radical uncertainty but also the possibility to sustain our reality, including human societies, and therefore the intrinsic nature of (un-)sustainability. The second hypothesis, which is related to the first one, is a normative one that drives to a conception of sustainability through a unique type of concern. A first consequence of this attitude is a particular selection of "interesting" indicators and of the method to use them: the aforementioned management of renewable resources through the discounting principle is a typical example of this method. The resource is generally reduced to specific indicators that are directly related to profit generation and risks

[48] "*[…] for much of ecology and resource management science, complexity is still a subversive idea that challenges the basis of population and yield models. However, as early as 1977, Larkin (1977) pointed out in a seminal paper that the maximum sustainable yield concept assumes away such complexity as food-web relations and focuses on single species yield, in isolation from other dynamics. Another study, by Lugo (1995), pointed out that trying to quantify supposedly sustainable levels of yield in tropical forests rarely leads to ecosystem sustainability*" (Dedeurwaerdere, 2014).

for shareholders; then the level of stock reached at the (dynamic) equilibrium, and thought as being sustainable, depends on this choice and on the predetermined rate of return, which is an arbitrary number only based on the desire of these actors. Therefore, we interpret the result of this management as being "sustainable" ((Perman et al., 2003), (Conrad, 2010)), whereas it is only a mere outcome of the realisation of the will of particular stakeholders. Moreover, thanks to this reduction of the ontology of real entities, these last ones *become* substitutable, even with manmade goods (Fromm, 2000): these substitutions are only able to the detriment of special features of these entities that could be absolutely necessary for securing sustainability, and therefore, we are again in a situation where reality exceeds the *a priori* and non-negotiable imposition of a specific attitude to our world. Finally, as explained by Allenby, Complex Adaptive Systems (CAS), such as biodiversity, ecosystems or humans, "*imply a different relationship between the observer and the system than that we usually assume when doing traditional reductionist scientific analysis. [... The] boundaries of the system to be studied are not determined by the structure and dynamics of the 'external' system itself, but by the query which one poses. [... While] particular ontologies may indeed be adequate for specific studies or research areas, no single ontology is sufficient in itself to capture a dominant totality of what actually exists*" (Allenby, 2005). As an outcome, the single ontology decreed by the shareholders' point of view is absolutely not sufficient to tackle CAS: a plurality of perspectives on these entities, which at least must include those of concerned scientists, is necessary to give the possibility to these entities to "talk" about themselves ((Latour, 2004a), (Rambaud & Richard, 2015)).

At the end, natural (resp. human) capital maintenance from a FfH viewpoint is only a management of a distant static reality, reduced to a set of variables, for a profit purpose, and absolutely not a maintenance of the natural (resp. human) entities themselves. Thanks to confusion regarding the term "natural (resp. human) capital", the principle of maintenance is kept, whereas the natural (resp. human) entities can be overexploited, in a non-sustainable way, *because of* this capital maintenance, while arguing that firms and investors pay close attention to the natural (resp. human) capital. Moreover, this ambiguity leads to another confusion, this one between means and ends. Whereas the term capital is initially related to a liability (as proved in part II) and thus should imply a responsibility towards the "natural (resp. human) capital" themselves, the FfH model implies an asset conception of the natural (resp. human) capital, which reduces them to mere means. In fact, this ambivalence is also at the core of the separation of economic, accounting and finance actors concerned by ecology and strong

sustainability, who demand, for instance, a preservation of the *critical* natural capital ((Gray, 1992), (Turner, 1999)) as a protection of real entities, and the followers of the Fisherian conception of the natural capital.

To sum up these ideas and to make a transition with the following section, we can use the terminology of Norton; this author distinguishes a pure welfare approach of natural capital, where only welfare and profits count, from a stuff-based perspective, where what must be maintained is not welfare but also some material and real "stuffs". The FfH model, which is based on a welfare approach, implies therefore a "Grand Simplification" (Norton, 2005) of sustainability and a loss of a sense of responsibility towards our common world. Achieving sustainability implies therefore first shifting from a welfare-based approach of capital to a stuff-based one, and then focusing on its complexity and the obligations towards it: in these conditions, we claim that the "traditional" accounting constitutes a "natural" way to "do this job". Thanks to this orientation, it will be possible to give some insights into what would be a genuine "sustainable" finance, a finance that CARES.

IV. Towards a finance that CARES

IV.1. The extension of "traditional" accounting to human and natural capital

In the same way that we proposed to sum up the key points of the extension of the FfH model to natural (resp. human) capital, the following tables (tables 6 and 7) give the general structure of what should be the "natural" extension of the traditional accounting framework to the natural (resp. human) capital. This extension is precisely the CARES model.

		Traditional Accounting Framework	Consequences for the natural capital
1	Capital	Capital is a "substantial" entity (money) Capital is independent from the activity of the firm	Natural capital is a generic term designating a particular set of non-human, substantial and concrete entities, which need deep examinations to define them and co-exist with them[49] ((Latour, 2004a), (Allenby, 2005)) Natural capital is "stuff-based" capital (Norton, 2005) Natural capital is independent from the corporate activity, and its "essence" exists outside the firm
2	Capital & income	Capital and income are strictly separated	Natural capital is strictly independent from income
3	Capital & Balance Sheet (BS)	Capital is a credit concept Focus on the right-side of the BS	Natural capital is a credit concept Natural capital is a liability that represents the responsibilities that a firm has towards the entities that form this capital Focus on the examination of the natural capital
4	Capital & Assets	Capital and assets are strictly separated Assets are utilisations of capital	The natural assets corresponding to the natural capital represent the different and generic types of utilisation of the natural capital Natural capital is not an asset: the entities inside the natural capital are not mere means and are recognized as having to be protected
5	Capital maintenance	Maintenance of an intrinsic essence of the capital, defined outside the firm Maintenance at the level of the firm Planned depreciations are recorded to guarantee this maintenance	Maintenance of the entities, inside the natural capital, for "themselves", *i.e.*, according to what they are intrinsically (this last term needs to be clarified) Maintenance at the level of the firm: this one implements this particular protection Planned depreciations are recorded to guarantee this maintenance[50]

Natural capital from a traditional accounting conception (1st part)

Table 6

[49] The natural capital *really* extends the capital-as-money of the "traditional" accounting: there is no reduction of natural entities to the classical accounting capital (money), even if there is a monetary evaluation. Ontologically, a natural capital is different from the traditional accounting capital (the conception is symmetrically opposite to the conception of the FfH model).

[50] We stress the fact that this depreciation is not of the natural capital itself (in the traditional accounting, we do not depreciate the capital-as-money) but rather of the assets, which correspond to the utilisations of this type of capital. Nevertheless, the purpose of this depreciation is not to protect the asset but rather the natural capital itself.

		Traditional Accounting Framework	Consequences for the natural capital
6	"Matter of concerns"	Capital protection	Protection of each type of natural capital *independently*
7	Corporate ontology	A firm has a real existence, independent from owners/shareholders Entity Theory	A firm has a real existence, independent from owners/shareholders Entity theory, extended to other types of stakeholders who *represent* the natural capital Natural capital increases the book value
8	Income	Based on the principle of realization	Based on the principle of realization
9	Income purpose	Measuring the available surplus, after securing the integrity of the intrinsic essence of the capital (money)	Measuring the available surplus that does not jeopardize the integrity of the entities that form the natural capital
10	Rates of return	Consequences of the activity of the firm Residual	Consequences of the activity of the firm Residual These rates of return depend on natural capital but do not condition their intrinsic existence
11	Future & Uncertainty	Future is tackled through possible scenarios (budget accounting), based on capital protection Possibility to cope with Knightian uncertainty (F. H. Knight, 2002)	Future and uncertainty are tackled through possible scenarios that must be adjusted regularly to take into account the reality of the firm and its utilisation of the natural capital (extension of budget accounting) These scenarios relies on the natural capital protection axiom; thus, the future possible uses of the entities, which form this capital, must be assessed to guarantee this maintenance Convergence between a processual and collective thinking of accounting and ecological thinking [51] ((Latour, 1998), (Callon, Lascoumes, & Barthe, 2009), (Dedeurwaerdere, 2014), (Rambaud & Richard, 2015))
12	Economic system	Based on the circulation of goods and money Pragmatic conception of prices	Based on circulation of goods and different types of capital, as independent entities Natural capital evaluation does not depend on (dynamic) equilibriums but rather on the way that the entities, which form the natural capital, interact with the economic system (in particular with the firm that used it, its stakeholders, the institutions, *etc*.)

Natural capital from a traditional accounting conception (2nd part)

Table 7

[51] Ecological thinking is not mere environmental thinking but is rather a general attitude towards our common world, based, in particular, on a relational and processual thinking ((Latour, 1998), (Whiteside, 2002), (Eckersley, 2004), (Forsyth, 2004), (Latour, 2004a)); in particular, "*'ecologising' means creating the procedures that make it possible to follow a network of quasi-objects [as interacting human and non-human entities] whose relations of subordination remain uncertain and which thus require a new form of political activity [as a collective, democratic, lucid and reflexive activity] adapted to following them*" (Latour, 1998).

Concretely, the "Triple Depreciation Line" (TDL), developed in (Rambaud & Richard, 2015) and which constitutes an extension and a systematic theorization of the CARE[52] accounting framework initiated in (Richard, 2012a), provides a complete accounting model that theorizes and operationalizes this conception of the natural (resp. human) capital and therefore the CARES model. More precisely, this accounting framework first gives a (re-)definition of a capital (financial or not), to apply symmetrically the historical accounting principles to extra-financial types of capital. In these conditions, capital is defined as a resource recognized as having to be maintained over a predetermined period. In these conditions, a "*resource cannot be considered as capital without actors attaching an ontological description to it and having a concern to preserve it over a given period according to this ontological specification. These actors can be called the representatives or spokespersons of the capital*" (Rambaud & Richard, 2015). This necessity to attach representatives to capital must be compared, for instance, with the aforementioned quotation of B. Allenby: these representatives[53], whose numbers and qualities must be regularly re-assessed, must guarantee a non-reductionism and a plurality in the examination of what the concerned capital are. They are not real stakeholders but rather intermediaries with the concerned capital themselves. This view is in line with line 1 of table 6.

Moreover, the TDL model is structured by six axioms. The first one (called SA1[54]) 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 financial[55]. 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[56] [57] (in accordance with lines 1, 5 and 6 of table 6). This must be done

[52] "Comptabilité Adaptée au Renouvellement de l'Environnement"
[53] 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 identity. 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.
[54] SA means Social maintenance Assumption.
[55] There is, in this way, a strict equality of treatment of all these types of capital.
[56] An implication of this assumption is the obligation of regular re-assessment of these definitions and thus of the different types of representatives concerned.
[57] This attitude towards the different types of capital is clearly very different from the FfH model. In the CARE/TDL accounting framework, each capital must be truly understood in its role within the Earth's ecosystem

with the recourse of the representatives. The third axiom (called AA1[58]) 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 (in accordance with line 3 of table 6). The next assumption (called AA2) asserts that the repeated use of the natural and human types of capital implies their systematic degradation (in accordance with lines 4 and 5 of table 6). 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.

These assumptions *imply* in particular four main consequences: (1) At first, the degradations of the natural and human types of capital must recorded through the systematic and planned depreciation of the assets, which correspond to the utilisations of these capitals[59]. Therefore, the TDL model highlights the absolute necessity of reporting and taking into account, in a systematic way, the repeated uses that are the main sources of degradations of natural and human entities today (such the progressive soil erosion for the natural capital and the stress and the muscular-skeletal diseases for the human capital). (2) Furthermore, the human and natural types of capital must be valued in terms of money in the balance sheet, 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. For instance, in the case of the human capital (the employees), "*the maintenance costs can be interpreted in three main ways: costs directly paid to workers (to ensure them worthy living conditions), internal expenditures for better working conditions, and internal expenditures for high quality training. The precise definitions of the terms ''worthy'', ''better'' and ''high quality'' are associated with a workers' ontological investigation [through collective and regular debates with the representatives of the workers]*" (Rambaud & Richard, 2015). In the general case, these costs must be collectively and regularly

and not as a simple asset for shareholders. Moreover, the presence of these "spoke-persons" implies new types of governance for firms.

[58] AA means Accounting maintenance Assumption.

[59] Of course, in case of irregular uses, extraordinary depreciations will be registered.

(re-)assessed by the representatives of the concerned capitals and the firm, according to the ontology of these capital collectively defined by these representatives (in accordance with line 7 of table 7). 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 one to cope with genuine uncertainty (Rambaud & Richard, 2015) – in accordance with line 11 of table 7. At the same time, this practice of periodic revisions is a common task of "traditional" accountants, which is why, in line with line 12 of table 7, capital evaluation is pragmatic, based on objective and subjective elements. (3) Moreover, 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, 2015). This means that there are three different depreciation lines (hence the name TDL) in the P&L statement, one for each type of capital. In this statement, wages expenses no longer have reasons to exist: "*indeed, the only expense that corresponds to worker use is a depreciation expense, whereas the maintenance costs are still considered investments*" (Rambaud & Richard, 2015). Furthermore, because employees (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" (in accordance with line 7 of table 7). (4) Finally, contrary to models such as the Triple Bottom Line (TBL), which define several types of benefits or performances, the TDL model proposes a real integrative view that leads to a single measure of profit, a concept of profit totally transformed due to the systematic maintenance of human and natural capital but very similar in its form to the traditional profit (in accordance with lines 8 and 9 of table 7). 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

This income is a genuine measure of the surplus generated by a firm after having fully protected the different types of capital. Thus, the income is completely separated from the very nature of the concerned capital (in accordance with line 2 of table 6) and is based on taking into account the degradation of these capital. The rates of returns are also merely residual: they are computed after realisation of the income and therefore after full capital maintenance (in line with line 10 of table 7).

The TDL model highlights the fact that there is a strong convergence between the traditional accounting framework and today's ecological approach of sustainability, which we can consider, by definition, as a *genuine* sustainability: indeed, the way the "traditional" accounting treats the capital (money) provides an accounting way to take seriously the different entities of our common world and the conception of procedures to co-exist with them, as recommended by ecological studies ((Latour, 1998), (Forsyth, 2004), (Dedeurwaerdere, 2014)). The TDL model can be seen as an operationalisation of this junction. In particular, thanks to the "traditional" accounting thinking, it is possible to design a concrete and feasible accounting system that strictly focuses on *real* natural and human entities themselves; and, if we take again and adapt the definition of the ecologisation of society to achieve a genuine sustainability according to Latour (1998), which can create procedures that make it possible to follow a network of interacting human and non-human entities (thanks to collective and regular debates with representatives) whose relations of subordination remain uncertain and which thus require a new form of corporate activity adapted to following them.

Thus, from this base, it is now quite easy to give a sketch of what could be a genuine sustainable finance. We will focus in particular on the way the TDL model can allow a re-definition of the Free Cash-Flows (FCF) and the conception of the rates of return.

IV.2. The transformation of traditional finance into sustainable finance

IV.2.a "Sustainable" Free Cash-Flows

The concept of FCF is, generally speaking, associated with the FfH model: from a Fisherian and Hicksian perspective, corporate capital is a stream of future free cash-flows (receipts or services that are equivalent to FCF at the level of corporate activity). In these conditions, and in accordance with table 2, these FCF are the maximal distributable dividends,

whose purpose is to compute a capital value as a discounted value of these flows. The capital value is assimilated to the value of the firm as a commodifiable object, owned by shareholders (Peleg, 2014). As shown before, this approach is unsustainable. However, the problem does not stem from the monetisation itself ((Rambaud & Richard, 2015), (Richard, 2012a)) or the existence of FCF, but, in line with the arguments of parts II and III, from the conception of the FCF (how are they defined? What is included in this notion?) and their utilisations. In these conditions, an important outcome of the elements developed in parts III and IV.1 is the fact that a sustainable FCF (SFCF) should be understood through the structure of the TDL model. Whereas this accounting framework focuses initially on the redefinition of the balance sheet and the P&L statement, it is possible to deduct its consequences for the re-conceptualisation of the cash flow statement: a SFCF can thus be seen as a result of this new type of statement.

The standard definition of a FCF is "*[...] the cash flow that a company is able to generate after considering the maintenance or expansion of its assets [...]"* (Rich, Jones, Heitger, Mowen, & Hansen, 2011). Thus, because the TDL's income is a measure of the whole surplus of the firm after securing the integrity of the different types of capital-as-real-entities, a FCF in the TDL framework, and therefore from a CARES perspective, becomes a periodic measure of the cash flow that a firm is able to generate after considering the maintenance or expansion of its different types of assets, corresponding to the utilisations of the financial and extra-financial types of capital-as-real-entities. More precisely, to correctly understand what this definition means, it is necessary to have recourse to an illustrative example (based on an example proposed in (Rambaud & Richard, 2015)): a farm F buys a field at the beginning of year 1, for an amount of 1000. The field representatives are scientists and a local environmental protection NGO. These representatives, jointly with the farm, set up a level of field maintenance, which is based, for instance, on several co-determined indicators. They also decide that this field must be examined at the end of year 3 to ascertain whether it is preserved, according to the chosen indicators. The firm indicates that it would like to use this field for two different types of production: a production of wheat during the three years and a production of corn from the beginning of year 2 until the end of year 3. The procedures to maintain this field and the corresponding maintenance costs, which constitute the value of the natural capital, are determined by the field representatives, according to the utilisation type needed by farm F. Jointly with F, they develop the following cost schedule and the causes of these costs in each case:

Causes for the costs	End of Year 1	Year 2	End of Year 3	Natural Capital Value
Production of wheat	1200	1500 *End* of Year 2	1500	
Production of corn	Not started	500 *Beginning* of Year 2	700	
Total	1200	2000	2200	**5400**

Costs allocation for natural capital maintenance

Table 8

In these conditions, at the beginning of the first year, the TDL balance sheet will be the following:

Balance Sheet – Beginning Year 1			
Field	1000	Financial Capital (money)	1000
RU[60] Fut.U[61]	4200 1200	Natural Capital	5400

First, we note the clear separation between the financial capital and natural capital sections. Second, two types of utilisations of the natural capital are recorded: the production of wheat for three years (which entails a total cost of 4000(=1200+1500+1500) for the maintenance of the field due to this particular use) and the future production of corn, not started at this time. Moreover, because the production of wheat will last three years, this utilisation is recorded as a "repeated use" asset. At the end of the first year, we record, as explained in part IV.1, a depreciation expense corresponding to the degradation of the natural capital. This depreciation is equal to 1400(= 4200/3), i.e., the value of the asset corresponding to the production of wheat

[60] RU : Repeated Uses
[61] Fut.U : Future Uses

divided by the number of years of this production. Therefore, we obtain the following statements, if we suppose that sales for an amount of 2000 are recorded[62]:

Balance Sheet – End of Year 1					
Field			1000	Financial Capital	1000
Cash			2000		
RU_1	4200	1400	2800	Natural Capital	5400
Poss.U			1200		
				Income	600

P&L statement – Year 1			
Natural Depreciation Expense	1400	Sales	2000

Now, it is necessary to maintain the natural capital and thus to spend cash for this maintenance. The planned cost for the first year is 1200. This expenditure corresponds to a particular investment, which can be seen as a "de-depreciation". The statements obtained are the following:

[62] We highlight that the *whole* balance sheet is balanced.

Balance Sheet - End of Year 1 (after de-depreciation)					
Field			1000	Financial Capital (money)	1000
Cash			800		
RU	4200	1400-1200	4000	Natural Capital	5400
Poss.U			1200		
				Income	600

P&L statement – Year 1			
Natural Depreciation Expense	1400	Sales	2000

Then, as planned, at the beginning of the second year, it is necessary to record an expenditure of 500 for the maintenance of the natural capital because of the start of the second production (production of corn). Therefore, we obtain the following statements[63]:

Balance Sheet - Beginning of Year 2					
Field			1000	Financial Capital[64]	1600
Cash			300		
RU_1	4200	200	4000	Natural Capital	5400
RU_2			1200		
Advanced DDP[65]			500		

[63] We separate the production of wheat (RU1) and production of corn (RU2) to make this example clearer, but this precision is not required by the TDL model.
[64] Including retained earnings.
[65] DDP : De-Depreciation

The maintenance cost of the natural capital corresponds to an advanced de-depreciation because this one will be recorded at the end of the second year. Finally, at the end of year 2, after de-depreciations, we get these statements, if we suppose the same sales:

Balance Sheet - End of Year 2					
Field			1000	Financial Capital	1600
Cash			300+2000-1500[66]		
RU_1	4200	200+1400-1500	4100	Natural Capital	5400
RU2	1200	600-500	1100		
				Income	0

P&L statement – Year 2			
Natural Depreciation Expense	2000	Sales	2000

Here, the whole natural depreciation expense is equal to the sum of the depreciation coming from RU_1 (1400) and the one from RU_2 (600 (=1200/2)).

This generic case makes it possible to understand how the conception of FCF is structured in the TDL model and to see why the SFCF are genuine extensions of the traditional FCF to extra-financial types of capital. Indeed, at the end of the first year, to maintain the natural resources of the firm, i.e. the natural assets, – in other terms, to maintain the possibility to produce wheat –, it is necessary to maintain the natural capital itself through a de-depreciation. This de-depreciation is therefore an investment in a fixed asset created to secure the corporate productivity. We highlight here that the maintenance of this productivity is directly linked to the absolute necessity of maintaining the natural capital at the level determined collectively with its representatives. It may be possible to argue that guaranteeing the continuity of a given level of corporate activity only relies on securing some specific and useful features of the natural

[66] 1500=cost of maintenance due to the production of wheat for year 2

(resp. human) capital. Thus, this argumentation would assert that in this example, the maintenance of the productivity of the firm does not need this level of costs to protect the field itself but much less expenditure to only guarantee that this field would render the useful services required by the firm and, in fact, by shareholders. In addition, in fact, it would also be possible to continue this argument by claiming that this field may not be really necessary for the activity of the firm in the future and that it would be more optimal to finally destroy it and exploit another field or even change the corporate activity structure after this complete degradation. This way of thinking is obviously a radical comeback to the FfH model. The direct outcome of what we showed in part III is the impossibility of separating the "productive" part of a real entity (human or non-human) from its useless part: this belief is not only in direct opposition with the reality of our world but also with sustainability. This is why the maintenance of productivity requires a genuine protection of all of the different types of capital-as-real-entities. Therefore, the costs defined in the table 8 are not sub-optimized or too high; they are simply the necessary condition for sustainability.

In these conditions, what the firm spent at the end of the first year to de-depreciate the natural asset corresponding to the production of wheat is by definition a *capital expenditure* (CAPEX), for maintenance of assets. In the same way, the expenditures recorded at the beginning of the second year are also genuine capital expenditure (CAPEX): in this case, not for maintaining the corporate productivity but for expanding it. Indeed, thanks to these expenditures, the firm will develop its activity through a second type of production (production of corn).

As an outcome, the FCF for the first year are assessed at 800 (= 2000-1200), where 1200 is a CAPEX and for the second year, at 0 (=2000-1500-500). These FCF are therefore concretely the cash-flows generated by the firm after the maintenance of the corporate productivity (the corporate assets), based on the absolute necessity of maintaining the different types of capital. The difference between a FCF in the FfH model extended to natural and human capital and a SFCF rests therefore, at first, on the level of costs required for the maintenance and expansion of assets (directly connected to the costs for capital maintenance) and on the redefinition of CAPEX: the recognition of costs for the protection of natural and human types of capital-as-real-entities as costs fundamentally necessary to the corporate activity is a key point for achieving sustainability. A SFCF also entails a restructuration of the way we understand the different elements that form the FCF. As in the TDL model, wages expenses

disappear to be replaced by a human depreciation expense and profit sharing, and expenditures (present and future) are organized to clearly show the utilisation and degradation of the different types of capital; this conception must also be used for tackling a SFCF. The following table (table 9) sums up this structuration:

	Fisherian-(falsified) Hicksian model	**Sustainable Free Cash Flows**
Common points between the two approaches	+ Cash in (sales) - Cash out for suppliers and creditors - Cash out for the state	+ Cash in (sales) - Cash out for suppliers and creditors - Cash out for the state
Differences between the two approaches	- Cash out for wages - Cash out for investments	- Cash out or conserved[67] to maintain Financial Capital, through maintenance of Financial Assets - Cash out or conserved to maintain Human Capital, through maintenance of Human Assets - Cash out or conserved to maintain Natural Capital, through maintenance of Natural Assets
	= FCF for shareholders	= FCF for shareholders and employees

Structure of Sustainable Free Cash-Flows

Table 9

Thanks to this organisation of the FCF, it is now possible to precisely understand the financial structure of the firm from a sustainable viewpoint and therefore to give clear indications and incentives (or des-incentives) for investors concerned by (genuine) sustainability.

Moreover, these SFCF are not only destined for shareholders, such as in the FfH model (*cf.* tables 2 and 3), but also for the human capital, which means the employees. In table 9, the wages are replaced by cash out or conserved for human capital maintenance and by profit sharing (last line). We stress the fact that there is no similarity between human depreciation expense and wage expense; for instance, there may be a connection between these two notions because a part (and only a part) of wages may be seen as a way to compensate for the

[67] As in the case of the balance sheet at the beginning of the second year, where an advanced de-depreciation is recorded.

"degradation" of employees, but in general, there is neither a quantitative nor a qualitative correspondence between these two notions. Finally, in these conditions, the SFCF cannot correspond to the computation of a shareholders' value of the firm anymore. In these conditions, what are the reasons for the existence of this (sustainable) financial indicator?

IV.2.b. Consequences for the IRR

First, as noted before, these SFCF give, by themselves, quantitative and qualitative information for actors who seek sustainable investments. Another interesting utilisation of these SFCF concerns the computation of a sustainable internal rate of return (SIRR). We emphasize that there is a great conceptual difference between the use of an IRR and of a discounted value. Indeed, in the last case, the main concern is to assess a capital-as-a-fund and at the same time, to put a price on a firm-as-a-commodifiable-object and to calculate a shareholders' value. Therefore, we come back again to the FfH model. However, as explained before, the conception of a firm as an object whose existence depends only on particular stakeholders, the shareholders, corresponds to a drastic reduction of the complexity of the firm and its decision structure (Biondi, 2007), increases social, environmental and bankruptcy risks and leads to an impossibility to achieve sustainability. To be clear, the abandonment of this perspective is not similar to a dispossession for owners/shareholders but rather the simple recognition that sustainability requires another way of thinking about collective actions and decisions, where uncertainty, cooperation (even in a competitive world), regular re-assessment (even regular questioning), inter-relation and (re-)immersion in reality (*cf* part III.2) are key concepts. In this way, rather than thinking of genuine sustainability as a constraint and perhaps a revocation of some today's particular and prevailing positions for actors such as shareholders, it is precisely certain advantages and conceptualisations of our world and of the economic activity that should be seen as abnormal and mere constraints for sustainability. This means, for instance, that the FfH model, and in particular the corresponding corporate ontology, should not be considered as a normal way of thinking about firms, finance and sustainability but rather as a justification and a legitimation for *over*-exploitation and *over*-prevailing positions incompatible with sustainability. Thus, what is defended in the TDL model or in tables 6 and 7 for instance is not suboptimal from a FfH viewpoint, taken as a normal benchmark, but it is the FfH model that is itself out of any optimality from the reality of sustainability, taken as a reference and a starting point.

In these conditions, the SFCF cannot be designed to compute a fictive, and useless from a sustainability perspective, capital value. However, the possibility of assessing, perhaps (and in fact generally) approximately, an IRR corresponding to these SFCF could be a relevant indicator for investors concerned by sustainability. Thanks to this approach, it should be possible to know the *real* rate of return that a firm and an investment could generate without jeopardizing our common world. Moreover, such an indicator could also entail a virtuous circle: if investments are re-orientated to firms with the best SIRR, the sustainable management linked to these SFCF could be really enhanced, and in this way, the SIRR generated by such business would increase, leading to greater investments.

Finally, we highlight the fact that these SIRR would be, in general, largely inferior to today's IRR, considered as normal. Indeed, at first, due to the retention of funds to maintain the natural and human capital in a systematic way, the SFCF themselves would be lower, even much lower than today. Of course, more precisely, some of today's firms already concerned by genuine sustainability, such as organic farms, ecological industrial projects or even multinational companies such as Weleda[68] (Richard & Plot, 2014), should not experience a real decrease of their FCF if redefined as a SFCF. Here again, the purpose of SFCF is also to value such firms and their management for financing goals. From a general viewpoint, Gray claimed in 1992 that "*the probability is that no Western company has made a 'sustainable' profit [based on a theoretical framework close to the one described here] for a very long time, if ever*" (Gray, 1992). If it is true, it would simply mean that the average SIRR would be almost zero. In a more nuanced way, as far as the natural capital is concerned, although some studies have shown the significant burden of the maintenance costs of natural capital on the national income (Hueting, Bosch, & de Boer, 1992), others have shown only a modest financial drain ((Bebbington, Gray, Hibbitt, & Kirk, 2001) and more recently (Altukhova, 2013) at the micro-level for an agricultural firm. Moreover, another reason for assuming that the SIRR would be in general less than today's IRR stems from the question of temporality. A strong relation exists between IRR and time of production: because "time is money", if FCF are delayed for a reason or another, the corresponding IRR decreases. Now the fact that corporate sustainability requires focusing on and following the different entities that form the natural and human types of capital implies that time is needed for this activity. In fact, sustainability can also be understood as a deceleration of our socio-economic activities, not *per se*, but because of the necessity to take

[68] Whose corporate governance is, from the beginning, based on the concept of anthroposophy (Weleda, 2015).

time to understand and to experience our world (Stengers, 2007). Therefore, concretely, in the TDL model, the collective and regular debates between the firm and the representatives of capital imply an extension of the decision time, and thus, a decrease of the IRR. All in all, here again, these two possible causes for likely decreases of IRR are not real constraints but rather the causes for a convergence to a sustainable finance integrated in a sustainable finance.

V. Conclusion

In this paper, we defended the following positioning: on the one hand, the capital approach sustainability generated from the mainstream thinking of finance, economics and, more and more, accounting, which we called the Fisherian-(falsified) Hicksian (FfH) model, is strictly unsustainable for intrinsic reasons; on the other hand, there exists a convergence between the design of finance from a sustainability viewpoint and the capital approach of sustainability deducted from the traditional accounting framework (this convergence is what we called the CARES model). In these conditions, to define what could be a sustainable finance, we argued that we need, at first, to rely on the extension of the traditional accounting capital theory to extra-financial types of capital and then to study the consequences of this viewpoint for finance and in particular for FCF and IRR.

To achieve this goal, in the first section, we examined the FfH model as well as the traditional accounting approach to be able to establish a precise comparison between these two perspectives. Thanks to this critical analysis, we detailed, in the second part, the main reasons for the radical unsustainability of the extension of the FfH model to extra-financial types of capital. Finally, in the last part, we proposed a way to theorise and operationalise the capital approach of sustainability coming from the traditional accounting framework, thanks to the TDL model. From this model, we suggested a redefinition of FCF to obtain sustainable FCF. We discussed at the end the possible manners to use them for financing purposes. One of the main contributions of these new types of FCF is to allow a re-connection of firms and finance with the complexity of our world as well as to prove that a genuine approach of sustainable finance, a finance that really CARES, is possible outside the restricted space offered by the mainstream FfH model.

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