



36

Accounting goodwill from the perspective of quantum physics: will “Accountphysics” one day exist?

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Resumo/Abstract

The idea of applying physics concepts or methods to economic and/or social phenomena is not new. Quantum physics is increasingly entering the social world as a means of helping to explain social phenomena. We extend this approach by using concepts from quantum mechanics to investigate the economic nature of goodwill and present a new conceptual approach. After reviewing Barad’s concept of agential realism, we develop a quantum interpretation for the accounting world. In this theory-building exercise, we discuss quantum physics concepts such as entanglement, diffraction and intra-action among others to propose a physical and economic inseparability between goodwill and other company assets. We hold that the intangible elements that form goodwill (or intangible capital) do not have economic value just by virtue of “existing” in an organisation. Actually, both intangible capital (goodwill) and physical capital are “entangled”, and this entanglement forms the economic value of the company. Unlike Einstein, we conclude that the entanglement of physical capital and intangible capital through intra-action is not “spooky action at a distance” but a form of wealth creation (or wealth destruction) in companies.

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Abstract

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Keywords: Goodwill, Agential Realism, Quantum Physics, Quantum Social Science

1. Introduction

The subatomic world of quantum physics is increasingly entering the social world as a means of helping to explain social phenomena. Quantum social science is making significant progress as an emerging field in the social sciences (for reviews, see Haven & Khrennikov, 2012; Wendt, 2015). It is a recent development and no generally accepted criteria exist for mapping its borders (Höne, 2017). In this article, we use this unconventional and unfamiliar approach (Bruza, Wang & Busemeyer, 2015; Wendt, 2015) to investigate the economic nature of accounting goodwill and its relationship with other assets. Unravelling the nature of goodwill is an interdisciplinary task (Kliestik et al., 2018). Accordingly, concepts from other areas of knowledge, such as physics (Barad, 2007; 2010; 2014) and economics (Coase, 1937, 1990), were sought. Employing quantum mechanical principles in a social science environment can provide for potential additional insights (Haven & Khrennikov, 2012, p. 5). In particular, we seek support from the agential realism approach to answer the question: “how is goodwill able to generate residual income?” This question is explained by the entanglement of what we will call “physical capital” and “intangible capital” in this essay. In short, entanglement is an odd phenomenon in which seemingly separated quantum systems behave as one (Bruza, Busemeyer & Gabora, 2009).

Shenkar and Yuchtman-Yaar (1997) used an interdisciplinary essay to investigate the concept of goodwill with the aid of economics, marketing and sociology. We extend this kind of approach by using physics concepts. However, our goal is investigating not concepts of goodwill but rather the nature of accounting goodwill. This article may also have some practical implications, as we discuss some issues that involve accounting treatment of acquired goodwill. We offer new insights that can affect the regulation of goodwill – especially its subsequent measurement. This essay can be summarised as follows. When a company is about to be born it has only intangible capital (ideas, plans, strategies, etc.). When it dies, it has only physical capital (assets that will be used to settle liabilities). During the time between these two moments – equivalent to the going concern – the company works to render physical that intangible capital. In addition, intangible capital is renewed as new ideas, plans and strategies feed into

the decision-making processes throughout the company's life. According to Sarasvathy (1998), an idea is any (or a combination) of the following items: (i) a product or service; (ii) a technology or innovation; and (iii) a market need. The author introduces and discusses the concept of pre-firm and states that the pre-firm processes transform an idea into a company.

We consider that ideas, plans and strategies in managers' minds act as drivers for the process that we will call here "*Firmforming*" (in reference to the term "Terraforming"¹ or "Terraformation" in astrophysics). This process is taken here as the transformation or "*tangibilisation*" of the pre-firm (ideas, plans and strategies) in a (new) company specifically. "*Firmforming*" is also closely linked to the business combination process – hence the term "new" in the previous sentence. In this case, the pre-firm is contained not only in acquirers' minds, but also in the environment of the acquired company.

The ideas of physical capital and intangible capital are similar to Lustosa's (2017) work in which the author explains the nature of goodwill based on the economic measurement of management decisions. From that, a contribution margin (revenues less costs) from each decision is measured using the economic concept of opportunity cost (Coase, 1937; 1990). Following this approach, we also conclude that the economic value of the company is formed by: (i) "physical capital", which is obtained when all assets and liabilities resulting from transactions that have already occurred or been implemented are measured at their respective opportunity costs (assets/liabilities individually identified, tangible or intangible, and reflected in the balance sheet); (ii) "intangible capital", represented by the difference between the company's economic value (present value of expected future economic earnings) and physical capital.

We hold that the intangible elements that form goodwill (or intangible capital) do not have economic value just by virtue of "existing" in an organisation. In fact, it is inter(intra-) acting with the other assets to achieve the purpose (or mission) of the firm. We claim that the nature of goodwill should be considered as a set of forces that act as drivers of profit in excess. This set of forces does not exist separately from physical capital. The theory presented in this article supports the idea that goodwill alone is not able to create abnormal earnings, because intangible assets need to be combined with other assets to create value (Kaplan & Norton, 2004). In other words, value creation involves the transformation of ideas into physical (real) capital. This is like saying that the inspiration of brilliant minds like Leonardo da Vinci, Ludwig van Beethoven or Nikola Tesla would be of no (or little) value if their ideas had not become physical capital in the forms of the *Mona Lisa*, the ninth symphony or the transmission of alternating currents, to name just a few examples. This relationship between goodwill and physical capital creates the firm's oneness and drives the generation of residual income.

Even today the controversy around goodwill remains in evidence. Regulators and financial statement preparers have sought a definitive form for their accounting. Financial Accounting Standards Board (FASB) and International Accounting Standards Board (IASB) have projects underway to rethink the treatment of goodwill, and this has turned the spotlight back on the subject (Betancourt & Irving, 2019). This underlines its persistent instability within the regulatory framework and the difficulty of finding a satisfactory accounting practice (Rubio, Martínez & Mazón, 2020). Perhaps the great controversy that still hangs on the topic is due to the lack of understanding or consensus on the nature or economic essence of goodwill. In view

¹ A term originally coined in the 1940s by writer Jack Williamson. It can be understood as a planetary engineering process on a global scale, whereby the environment of a planet is modified so that it can sustain human life. The goal is to transform the atmosphere, temperature, ecology etc. of another planet (Mars is the main candidate today) in order to create ideal environmental conditions for human beings (Fogg, 1993).

of this, the objective of this article is to present a theoretical underpinning that supports comprehension not only of the dynamics of goodwill with the company's physical capital, but also of the very nature of goodwill. The predominant literature states that goodwill is related to the company's ability to obtain residual income (Leake, 1921; Walker, 1953; Martins, 1972; Johnson & Petrone, 1998; Henning, Lewis & Shaw, 2000), that is, goodwill is an asset whose value depends on future factors (Ding, Richard & Stolowy, 2008). According to Courtis (1983, p. 10), Walker (1953) argued that goodwill has no accounting significance except in terms of its ability to generate residual income. An amount paid as goodwill occurs "because profits in excess of a normal return on the investment are anticipated. In other words, an enterprise is purchased, not primarily as a means of securing a group of assets, but as a means of securing a stream of income in the future". We totally agree with that statement and we will use this concept of goodwill to explain its relationship with other assets.

The remainder of this article is organised as follows. Chapter two is divided into four sections. The first section relates goodwill with both quantum social science and agential realism. The second section discusses quantum entanglement and relates it with goodwill. The third section relates quantum diffraction and goodwill. The final section highlights the issue of measurement. In the third chapter, we briefly discuss the controversy surrounding the topic. In addition, we reinforce the approach based on the concepts discussed previously. The final chapter presents our concluding remarks.

2. Theoretical Basis

2.1. *Quantum Social Science and Agential Realism*

The idea of applying physics methods to social phenomena goes back to the nineteenth century (Stauffer, 2013; Kutner et al., 2019). In 1979, the French theoretical and philosopher of science Bernard d'Espagnat stated that "the doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and with facts established by experiment" (d'Espagnat, 1979, p. 158). From the first discoveries of the founders of quantum mechanics – Planck, Bohr, Einstein, Heisenberg, Schrödinger, among others – we observed an extraordinary modern *Mahabharata*², which would cross the 20th century through the present day (Nicolescu, 1999). Nowadays, sociophysics and econophysics (will "*accountphysics*" one day exist?) are approaches which use ideas, models and conceptual methods of physics applied to socio-economic phenomena (Kutner et al., 2019).

In turn, quantum social science is a term used to refer to the application of quantum physics concepts to the modelling of social interactions (Bawden, Robinson & Siddiqui, 2015). It has as its goal the investigation of problems within the wide remit of the social sciences, whether they touch on economics, finance, psychology, sociology or other domains of inquiry (Haven & Khrennikov, 2012, p. 62). As stated by Wendt (2015, pp. 2–3), "The mind and social life are macroscopic quantum mechanical phenomena (...) human beings and therefore social life exhibit quantum coherence (...) this argument is not an analogy or metaphor, but a realist claim about what people really are". Quantum social science has been working on multiple

² Epic tale, Hindu scripture, philosophical treatise, and national history, the Mahabharata ("the great Bharata") is India's most massive repository of knowledge about Hindu thought and life in classical India (source: oxfordbibliographies.com).

problems, including: financial asset pricing; decision making; quantum game theory; and new social science concepts (Haven & Khrennikov, 2012, p. 70).

The understanding of the nature of goodwill is anchored in the assumptions of sociomateriality, in particular the agential realism proposed by Karen Barad.³ This theory helps us to understand materiality as part of social phenomena (Orlikowski, 2007; Schatzki, 2010), given that this article proposes the physical and economic inseparability of physical capital from intangible capital. Barad's agential realism has consequences for the understanding of what the social world is. Even using quantum physics, which involves subatomic scales, as a basis this does not result in the inapplicability of scientific perceptions to understanding the daily life of human beings (Fonseca, 2018). Bourdieu, Chamboredon and Passeron (1991, p. 23) state that:

Scientific rigour by no means obliges one to forswear all use of analogical schemes for explanation or understanding, as is shown by the use that modern physics can make of paradigms – even mechanical ones – for didactic or heuristic purposes. But they still have to be used scientifically and methodically.

Quantum physics is arguably the most successful scientific theoretical achievement that humans have ever created (Busemeyer & Bruza, 2012). Bohr's philosophy of physics can be considered an appropriate starting point for thinking about how the natural and social worlds work together and getting important signals on how to theorise the nature of the relationship between them. His investigations on quantum physics open up questions about the nature of scientific and other social practices (Barad, 2007, p. 26). It is in this spirit that an alternative proposal was sought to understand the nature of goodwill. Perhaps much of the controversy and lack of consensus on the topic can be elucidated from this approach. Thus, the idea about the nature of goodwill came from asking: "how is goodwill able to generate residual income?" Ma and Hopkins (1988) claim that to understand the nature of goodwill it is necessary to go beyond the question of measurement and ask why residual incomes exist. Furthermore, we also question the relationship between physical and intangible capital. How do they interact? Are they really separate entities? Does one prevail over the other? These and other questions directed our research on theoretical literature to the field of sociomaterialism (neomaterialism).

The initial context of agential realism is inserted in the theoretical assumptions of neomaterialism, which has the general theoretical assumption that the social and the material are so fundamentally related that it makes little sense to speak of one without speaking of the other (Leonardi, 2013). According to Kautz and Jensen (2012), debates about sociomateriality in organisational studies were introduced on the basis of studies by either Orlikowski (2006; 2007; 2009) or by the same author and Scott (Orlikowski & Scott 2008; Scott & Orlikowski 2009). Leonardi (2013, p. 61) states that these first debates about sociomateriality were influenced by the works of Latour (1987; 2005), maintaining that phenomena can only be described properly if researchers direct their attention to the empirical reality that people, ideas, objects, artefacts, nature and the like are all gathered in an intricate network of associations.

³ Karen Michelle Barad is a physicist and historian of science and teaches feminist theory, philosophy and history of consciousness at the University of California. Her research revolves around feminist theories, history, philosophy of physics in the twentieth century, epistemology and ontology. In some articles and in her work "Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning", she has developed the notion of agential realism, which rethinks the traditional notion of human agency, decentralising it by understanding "agency" as dynamic reconfigurations that shape the world. (Source: <https://andrevvital.wordpress.com/2015/06/27/o-que-e-intra-acao-por-stacey-kerr/>).

Cecez-Kecmanovic et al. (2010) point out that technologies, people and organisations are not seen *a priori* as autonomous entities that influence each other through impacts or interaction. Instead technologies, people and organisations are seen as constitutively entangled, which implies that we can only separate them analytically.

Reflecting on the concepts addressed in neomaterialism for the field of physics, especially the quantum theory studies by Nobel Prize winner Niels Bohr, Barad (2003, p. 801) questions the paramount importance attributed to language and culture at the expense of the material:

How did language come to be more trustworthy than matter? Why are language and culture granted their own agency and historicity while matter is figured as passive and immutable, or at best inherits a potential for change derivatively from language and culture?

Thus, Barad seeks to raise materiality to the same level as language and culture, as an active participant in the future of the world, in its continuous “intra-activity”. And with this objective, Barad (2003) maintains that there is no ontological distinction between the representations and the entities to be represented. The need to adopt an asymmetric view in relation to representations rather than things is just a Cartesian mental habit. Barad’s intention is to (re)construct a whole theory about space, time, matter, causality, agency and subjectivity that interconnects the material (physical) and social (persons) worlds. Accordingly, we seek in the same way to present the relationship between intangible and physical capital. Barad does not postulate “nature” (the physical world) and “culture” (the social world) as belonging to different orders and scales of magnitude, in order to emphasise exactly the dynamism of the interactions between these two axes (Büscher & Veloso, 2018). Using concepts of sociomateriality and agential realism, Orlikowski (2007, p. 1437) postulates that:

... the social and the material are constitutively entangled in everyday life. A position of constitutive entanglement does not privilege either humans or technology (in one-way interactions), nor does it link them through a form of mutual reciprocation (in two-way interactions). Instead, the social and the material are considered to be inextricably related - there is no social that is not also material, and no material that is not also social.

By using concepts and assumptions stemming from agential realism to support the nature of goodwill, we intend to say that a company’s physical capital is a consequence of its inter(intra-)action with goodwill. In other words, intellectual capital, company’s reputation, employees’ motivation and expertise among others intangible elements that form goodwill are entangled, that is, intra-acting with the company’s tangible assets, products and/or services. It is this relationship between the intellectual (or intangible) and the material (or physical) that is capable of producing positive economic residue, if any, in the exchanges or individual transactions of tangible assets. This excess payment in a business combination does not turn into excess profits merely over time; if it did it should be included in the calculation of the acquired company’s net present value (NPV). When we say there would be (almost) no value if the ideas of brilliant minds do not become physical wealth, we are specifically talking about the innovative ideas that emerge within companies, whether through the staff or by top management.

2.2. Quantum Social (Accounting) Entanglement

Quantum entanglement was proposed by John S. Bell (1964), who showed mathematically an incompatibility between quantum mechanics and the concept of local realism proposed by

Einstein, Podolsky and Rosen (1935) in their “EPR paradox”. The proposal established by Bell took the form of a set of inequalities, known as “Bell inequalities”, which can be violated only by entangled systems (Souza, 2008). When two systems are entangled, a local measurement performed on one of them automatically collapses the state of the other (Wittmann et al., 2012). This concept went from being an abstraction to becoming a reality applied in practice, for instance in the area of cryptography (Tittel et al., 2000; Kovlakov et al., 2017).

A violation of Einstein separability requires instantaneous “spooky action at a distance” (term coined by Einstein when he talked about quantum entanglement), either between independent systems or within a single extended system (d’Espagnat, 1979). This makes perfect sense in the “physical–intangible” relationship, since a variation in a firm’s intellectual capital, for example, directly impacts its physical capital. A new idea in the organisation’s environment impacts its physical capital. Damage to the firm’s reputation impacts its physical capital (products/services). Likewise, trouble with physical capital also impacts its intangible capital, as people, technologies and the organisation are constitutively entangled (Cecez-Kecmanovic et al., 2010). When quantum entities become entangled, one cannot manipulate one constituent without simultaneously affecting the other (Bruza, Busemeyer & Gabora, 2009). Therefore, in the same way that quantum entanglement explains the relationship between two particles, the entanglement of accounting goodwill explains the relationship between both physical and intangible capital.

Agential realism proposes that discursive practices and material phenomena do not stand in a relationship of externality to each other. Instead, they are mutually involved in the dynamics of intra-activity, and the relationship between them is one of mutual entailment. Neither of them is ontologically or epistemologically prior. Neither of them is reducible to the other, nor can either be explained in terms of the other. “Neither has privileged status in determining the other. Neither is articulate or articulable in the absence of the other; matter and meaning are mutually articulated” (Barad, 2007 p. 152). From this perspective, we maintain that physical and intangible capital also overlap in the dynamics of intra-action. In other words, despite being valued in a business combination in the form of goodwill, intangible capital does not exist separately from physical capital (assets, products and services). Neither prevails over the other, so the economic value of the company is composed of the sum of the two.

The tipping point in this part rests on “intra-action”, since interaction presupposes the pre-existence of separate individual agencies that precede their interaction. The neologism intra-action refers to the mutual constitution of entangled agencies and assumes that different agencies do not precede one another, but emerge through their intra-action. And when it comes to “different” agencies, it is only in a relational sense, not absolute; that is, the agencies are different only in relation to their mutual entanglement, because they do not exist as individual elements (Barad, 2007 p. 33).

We consider that a company’s physical capital is the result of the idiosyncratic skills of its managers and employees. A company’s value creation is dependent on its human capacity to get the best out of the interaction between employees, machines, equipment, technology and so on. Thus, it is postulated that physical capital can be understood as the result of the application of acquired knowledge, idiosyncratic skills, experiences and the way the executive runs the company. This virtuous circle is renewed as new ideas and strategies emerge and are put into practice. Nowadays, continuous learning, development and renewal have become the main organisational capabilities that drive competitiveness (Kianto et al., 2018).

When any material good (or service) – for example, AT&T®’s service or the iPhone® – is observed, a certain amount of intangible capital is entangled in it. The product or service is not only the physical, but a whole entangled range of thoughts, motivations, ideas, beliefs, expertise, concepts etc. For its part, intangible assets seldom affect financial performance

directly. Instead, they work indirectly through complex chains of cause and effect (Kaplan & Norton, 2004). And when some differential in this (physical–intangible) entanglement occurs – such as the example mentioned – it is capable of generating abnormal earnings. Creating residual income is a hard task. It is not always possible for companies to achieve. Very few organisations are capable of maintaining a continuous or long-lasting flow of residual income. For this to happen, it is necessary for companies to be in a permanent state of change (innovation). As stated by Biondi and Rebérioux (2012, p. 279), “the specific economy of the firm is driven by complementarities, intangibles and innovation”. We will discuss this issue in detail in the next section on diffraction.

Managers’ ability to successfully meet future environmental conditions revolves around their understanding of organisations as integrated and dynamic wholes (Miles et al., 1978). The firm’s systemic view strengthens the understanding of the entanglement between physical and intangible capital. This systemically and harmoniously integrated whole would not be the same if any part of this gear were missing, or if any part stood out at the expense of another. The objective of the integrated system and of each of its elements is not, therefore, the maximisation of partial values. The systemic view of the company’s effectiveness implies the best way for an element to act in favour of the objectives of the system. This integration of the effectiveness of functional areas into the overall effectiveness of the organisation occurs, and is measured by the result. From this perspective, the organisation functions as highlighted by the baroque poet Gregório de Matos:

The whole without the part is not whole; the part without the whole is not a part; but if the part makes it whole, being part, let it not be said a part, being the whole. (Matos, 1998, p. 13) (our translation).

The systemic view also implies the belief that its subsystems are equally important. All of them work towards the firm’s objectives. This company approach – seen as an open system – is recommended by the economic management information system - GECON,⁴ which states that a company’s system is characterised by an interrelation of its subsystems, forming a dynamically integrated whole for an objective (Pereira, 2001, p. 37). This relationship can be described as follows (Guerreiro, 1989, pp. 170–171):

... people (social subsystem), with certain authority and responsibility (formal subsystem), provided with the necessary information (information subsystem) and conditioned by certain principles (institutional subsystem) interact in the decision-making process (management subsystem). Through the interaction of these subsystems, business functions (buying, selling, finance, etc.) are performed in order for the company to fulfil its mission (our translation).

Lustosa (2017) characterises goodwill as ideas, plans and intentions – that is, decisions that have not yet been substantiated by physical exchange of implemented assets or transactions. In a business which is a going concern, goodwill is realised by conversion into physical capital and is simultaneously renewed by new ideas, plans and strategies of the company’s management. This proposal is also supported by the concept of entanglement. We

⁴ GECON is a theoretical model of the nature of organisations that was developed at the University of São Paulo (USP) by professor Armando Catelli, between the late 1970s and the early 2000s. It systematically gathers knowledge from various fields, mainly of systems theory, administration, economics and accounting (Lustosa, 2017, pp. 12–13).

consider that intangible capital is pulsating in the moment before its realisation as physical capital. We are able to perceive this in several ways, such as the recognition of great corporate management or the intellectual capital of an organisation. On the other hand, we are also able to perceive the final product – that is, physical capital and residual incomes. However, because of our Cartesian view (or even space–time action), we are still not able to perceive the process of intra-action between physical and intangible capital. Only when we enter the subatomic world, we are able to perceive this complex process. As stated by d’Espagnat (1979, p. 181):

Most particles or aggregates of particles that are ordinarily regarded as separate objects have interacted at some time in the past with other objects. The violation of separability seems to imply that in some sense all these objects constitute an indivisible whole”.

We hold therefore that the agential realism, by borrowing the concepts of entanglement and intra-action from quantum physics, provides a solid basis for proposing this new approach to accounting goodwill.

2.3. Quantum Social (Accounting) Diffraction

It is also interesting to note that the nature of goodwill is closely related to management’s “intention to use”. This intention to use, in turn, is based on the specific ideas, plans and strategies of each administration. We illustrate this by way of an example which is well known in Brazil: the Banespa case. Spanish bank Santander paid a premium of about R\$7 billion for the acquisition of Banespa bank, as its plans allowed it to see excess profits that justified such payment. This amount differed considerably from other bidders at the time (Unibanco, Bradesco and Itaú). Certainly, whoever was the winner, the value attributed to goodwill would be different, given the particularities of each bidder. This strategy is idiosyncratic. It depends on the specific circumstances the acquirer is experiencing operationally and financially, the regional and global economic reality of the time, the moment when the manager ponders the opportunity and perhaps even the psychological conditions of those involved in the merger and acquisition (M&A) process. All of these and other factors are unique to any decision-making.

This issue is discussed in this section because agential realism also presents a concept that supports this premise. Diffraction is a term extracted from the field of physics “that refers to the way in which waves combine and move (...) The movements **implicate differences as generated from within**” (Højgaard & Søndergaard, 2011, p. 344 – emphasis added). The term appears as a metaphor in Haraway (1992), as a feminist tool to rethink differences beyond binary opposition and as an alternative to reflexivity (Kaiser & Thiele, 2014; Bozalek & Zembylas, 2017). Haraway is inspired by the optical phenomenon of diffraction as a metaphor and a method of knowledge production (Sehgal, 2014). Diffraction can serve, as pointed by Haraway, “as a useful counterpoint to reflection: both are optical phenomena, but whereas the metaphor of reflection reflects the themes of mirroring and sameness, diffraction is marked by patterns of difference” (Barad, 2007, p. 71). Barad’s agential realism advances in the use of the concept of diffraction as she does not consider it merely an optical metaphor, but also a method and a practice (Bozalek & Zembylas, 2017). As stated by Kaiser and Thiele (2014, p. 165), “with Barad’s quantized diffraction, a relational ontology emerges that can no longer be categorically separated from its epistemological processes”.

“Diffraction does not produce ‘the same’ displaced, as reflection and refraction do” (Haraway, 1992, p. 300). That is why goodwill finds support in the concept of diffraction, as goodwill (whether it is internally generated or acquired) has peculiar characteristics even in similar companies which varies according to the intention to use the assets. Given that intangible capital is latent in the minds of managers in the form of ideas, plans and strategies,

and given the inherent peculiarity of each person and each organisation, it is expected that goodwill will also manifest itself in a particular way in each organisation. Its effects are manifested in the firm's results – an idea supported by diffraction. According to O'Donnell et al. (2003) plans, ideas and strategy making are probably much closer to a quantum probability wave that changes its shape each time we observe it than they are to a linear and predictable Newtonian equation.

Haraway (1992, p. 300) states that “a diffraction pattern does not map where differences appear, but rather maps where the effects of difference appear”. It is precisely in the difference between companies that goodwill shows one of its main characteristics. As we stated in the previous section, creating residual profits is a difficult task. It requires that a company differentiate itself from its competitors and be in a constant process of change – of constant reinvention of itself. This occurs diffractively through the innovation of its products, services offered, work processes and so on. Regarding to acquired goodwill, a company offers an acquisition premium based on the unique characteristics that are conferred on it and how these characteristics can become entangled to gain a synergistic value created by the acquisition (Henning, Lewis & Shaw, 2000). This depends on a number of unique factors such as systems, machines, employees, suppliers and so on. “Systems influence individuals, and individuals call forth systems. It is this relationship that evokes the present reality. Which potential becomes real depends on the people, the events, and the moment” (Wheatley, 2006, p. 36). Perhaps because of that, applications of quantum theory have appeared in decision-making literature (e.g. Busemeyer, Wang & Townsend, 2006; Trueblood & Busemeyer, 2011; Yukalov & Sornette, 2011; Busemeyer & Bruza, 2012).

The physical–intangible relationship will always change after a business combination process. The (new) business environment, however small the impact of the acquisition, will be different to the one before the combination. When quantum entities become entangled, they form a new entity with properties different from either constituent (Bruza, Busemeyer & Gabora, 2009). This is supported by the concept of diffraction. Diffraction is not a defined pattern, nor is it a single event that takes place in space and time; on the contrary, it is a dynamism that is essential for space–time. Each moment is an infinite multiplicity (Barad, 2014). The incorporation of a company brings with it a minimum of ingredients that, added to the conjunction of other factors, modify the decision-making environment of the organisation. Sometimes this change is imperceptible in the eyes of top management, but it is there. Perhaps this is why economic measurement can help to better clarify the behaviour of goodwill.

Opportunity cost is now a cornerstone in finance, economic theory and decision theory (Ricci & Magni, 2014). When using the concept of opportunity cost and measurement at the decision-making level, the objective is to measure each phenomenon that alters a firm's economic wealth. This economic measurement is unique, since the forces acting at the time of the manager's decision are also unique: the cost of the opportunity overlooked, the economic scenario (macro and micro), the company's finances, the sector's budget, pressure from employees and/or shareholders, the institutional environment, politics, the mood of the decision maker, and so on. The unique environment experienced by the decision maker also finds support in the physical concept of diffraction. Understanding entanglement and diffraction requires a deep reflection not only on quantum physics but also on philosophy and other fields of study (Barad, 2007, p. 73). This theory-building exercise for the accounting field is just the starting point for further studies.

2.4. Quantum Social (Accounting) Measurement

The question that arises when advancing this analysis is how to measure the relationship between physical and intangible capital. Accounting, in general, measures equity elements and

their variation – that is, it assigns monetary values to objects or events associated with a company (Hendriksen & Van Breda, 1999, p. 304). This process occurs with the identification of objects or events to be evaluated and with the choice of attributes that are relevant to users of accounting information. Next, significant monetary values are attributed to these objects or events (Araújo, 2014, p. 104). However, increasing the importance of intangibles requires – in addition to the development of specific measurement tools for these assets – “the adoption of a different and more comprehensive conceptual view of organizational dynamics”. Such a view requires different measurement methods and tools (Lev & Zambon, 2003, p. 598). Intangibles are firm-specific resources (Biondi & Rebérioux, 2012).

Looking to agential realism, it is observed that the method of measurement must be based on the phenomenon. For Barad (2003, pp. 817-818):

The primary ontological units are not ‘things’ but phenomena (...) phenomena are constitutive of reality. Reality is not composed of things-in-themselves or things-behind-phenomena but ‘things’-in-phenomena (...) it is through specific intra-actions that phenomena come to matter – in both senses of the word.

A phenomenon can be understood as a specific intra-action between an “object” and “measurement agencies”; they emerge from (instead of preceding) the intra-action that produces them (Barad, 2007, p. 128). They are specific material configurations, not social constructions, but they are also not independent of human practices. Humans are not external to the world looking inward, but neither are we the sole cause of what the world is becoming (McQuillan, 2018).

Rather than referring to “objects” in the world, with certain limits and properties, Barad’s basic unit of reality is not the object but what Bohr calls “phenomena”, which are temporarily bounded and continuously performed through intra-action (Hetherington et al., 2019). Phenomena are ontologically primitive relationships, not merely the result of laboratory exercises designed by human subjects (Barad, 2003). Phenomena can be understood as inseparable physical–conceptual interactions which are measured by quantum probability. Indeed, the quantum formalism is about information and probability which can be gained through observations (Khrennikov et al., 2018). The phenomena are derived from a probabilistic nature (as if it were a superposition of several measurable states). When an observation is made, this superposition “collapses” to a single, measurable state. That means that, previous to measurement, the matter only exists as a set of probabilities and the very act of measurement (or observation) causes a single specific probability to come about – these are agential cuts (Dunk, 2020).

It is proposed that goodwill does not exist separately from the other, physical, elements of the firm. Rather, it only reveals itself during the phenomenological process through the intra-action between physical and intangible capital. And where do these phenomena occur? Which phenomena should be investigated and measured? The answer can be based on the field of economics. Iudícibus, Martins and Carvalho (2005) affirm that the challenge that accounting is uniquely qualified to face is first to capture the occurrence of economic events that impact a firm’s wealth status, then to price it and finally to communicate its effects. To do this, it relies on similar disciplines, such as law, economics and quantitative methods.

The aim of measurement focus on economic phenomena, more precisely “economic events”, which are characterised as the decisions that are made in the company and that affect its economic value. Analysing the concepts of capital, income and economic profit proposed by Fisher (1906) and Canning (1929), Lustosa (2017) states that, in any business, the wealth-generation process occurs continuously through thousands of interactions, in each of which new

wealth (service) is generated from the use of existing wealth (disservice). According to Cabrita and Vaz (2005), intellectual capital (part of goodwill) is a phenomenon of interactions, transformations and complementarities. In this way, the economic earnings for a period can be monetarily quantified. They would be the present value of the difference between the value of all new services generated (which increase wealth) and old services consumed (disservices, which decrease wealth).

This economic vision has been implemented in the GECON model, which labels as a “transaction” each one-time exchange of one asset (disservice) for another (service). A set of transactions of the same nature is called an “event”. The transaction is, for GECON, the central object in a manager’s decisions, similar to Canning’s “desirable event” (1929), since it is what produces the change in wealth (Lustosa, 2017). In line with this reasoning, Lima et al. (2011) maintain that a company’s activities and operations produce economic results and, consequently, modify its equity situation (which is why they are called economic events). In fact, this approach is widely used in economics. According to Ricci and Magni (2014), the notion of residual income implies that the economic value of the asset itself may be calculated with no recourse to cash flows, but only to abnormal earnings. It has been used extensively to construct performance measures that signal wealth creation (or wealth destruction) in a company.

These phenomena arise from the decisions of managers who refer basically, in this case, to the countless decisions made as a result of their business’s performance. For instance, when Martins and Santos (2017) present an example of goodwill generated by liabilities (financing obtained), what is behind that example – and is not discussed by the authors – are managers’ abilities to obtain competitive advantages in the form of financing for their activities. No company can finance itself advantageously at random. It is the company’s managers who analyse the various possibilities, consider their opportunity cost (or the cost of the neglected opportunity), and decide on the best choice – that is, the one that will result in the greatest returns or gains for the company.

In Coase’s view, businessmen use an opportunity-cost approach to make their decisions, but accountants do not help them in doing so properly since they have a different view of costs. Coase thus introduces the idea that the decisions of businesspeople are based on an opportunity-cost analysis (Bertrand, 2015). Opportunity cost is the value of a resource in its best alternative use (Coase, 1937). This means that the valuation of a resource (asset or liability) depends on the intended use by those who control it. Lustosa (2017) shows that the economic value of an asset obtained in a transaction can be derived from the mathematical rearrangement of the variables in the decision model. The resulting equation is adjusted at the transactional level to the notation that Ohlson (1995) used to characterise the residual income valuation (RIV) model at the company level. The sum of individual decisions from the beginning of the company until the current moment t will generate an RIV for physical capital, since it results from all management decisions already implemented. The remaining portion to obtain the total economic value of the company will be an RIV of potential management decisions, from t to a defined future T – intangible capital or goodwill.

3. Discussion

The controversial nature of goodwill has been puzzling the accounting community for more than a century (Baboukardos & Rimmel, 2014). Understanding goodwill is difficult for two reasons: (i) it is a residual value and has no associated discernible or separable assets; and (ii) it is about the future (Huikku, Mouritsen & Silvola, 2017). The approach used in this article for accounting goodwill (decisions that have not yet been substantiated by physical exchange of implemented assets or transactions) is not new. A similar approach to this has been debated

since the work of Myers (1977, p. 150), who states that a significant part of the market value of many companies is accounted for as “assets that do not yet exist”. Still on this line of reasoning, Ramanna and Watts (2012) emphasise that the value of goodwill is a function of future management actions, including the implementation of the company’s strategy. In addition, Spender and Marr (2006) state that goodwill reflects the company’s past performance, but also the expectations of third parties about the company’s future behaviour. The authors maintain that the understanding of the executives’ management capacity – of intellectual capital – in relation to decisions already taken would be only the first level of analysis given that “human capital should also include the potential for skilled performance under circumstances, **which have not yet arisen** – a sort of second loop or level of analysis” (Spender & Marr, 2006, p. 265 – emphasis added).

Newton’s mechanics support the accuracy of things. If you know, for example, the velocity and acceleration of a vehicle in the present, then you can state precisely where in space that vehicle will be at a given time T in the future. Following this approach from physics, accounting standards consist of conventional binary classification that suppress probabilistic nuances (Dye, 2002). However, in the microscopic world we cannot make such a statement. Quantum physicists speak in terms of probabilities, not prediction. They can calculate the probable moment and location of a quantum leap, but not precisely (Wheatley, 2006, p. 22). With goodwill the situation is similar. Johansson, Hjelström and Hellman (2016, p. 14) comment on some of the IASB’s positions in relation to International Financial Reporting Standards’ IFRS 3 (Basis for Conclusions). According to the authors, a main problem with the double accounting approach was that “the useful life of the acquired goodwill and the pattern in which it decreases are generally not predictable”; in this way the board understood that “the linear amortization of goodwill over an arbitrary period fails to provide useful information” (IFRS 3, BC 140).

When a machine operates alone, preprogrammed to produce a certain good (when there is little or no human interference), things work, in a way, according to Newtonian physics. Knowing that the machine generates n products every t minutes, then we know how many products will be ready in the future (under normal conditions, without externalities, of course). However, when intangible capital has a greater impact on the organisation (typical of modern economies) this measurement becomes more complex. The company is expected to produce n products, but this is a particular condition of each organisation, taking into consideration its intangible capital at that time. The problem becomes even more complex in those organisations where most of the capital is intangible. The greater the intangible capital, the more complex the relationship between goodwill and physical capital!

Decisions occur frequently in the day-to-day life of companies, most of whom change their wealth status without being subject to measurement by traditional accounting. But there is no claim in this article for any change in accounting procedures or standards in this regard. What is intended is to show that “traditional” accounting measurements do not allow the real nature of goodwill to be identified. For this reason, goodwill is treated as a residual value (Martins, 1972; Colley & Volkan, 1988; Eckstein, 2004; Huikku, Mouritsen & Silvola, 2017), and discussions about its nature remain limited to the knowledge generated by a few authors. The result of this is reflected in the lack of consensus in the accounting community. The historical evolution of goodwill shows us that, due to its complexity, the accounting community has presented a different and sometimes contradictory understanding of its definition, recognition and measurement. The difficulty observed in accounting for goodwill is due to its very nature, which is almost impossible to quantify. Therefore, it is also very difficult to find a precise method to measure the consumption of goodwill (Wiese, 2005).

Pinnuck and Shekhar (2013) claim that one of the most significant properties of accounting is the binary classification (the profit versus loss heuristic). However, we swim against the tide by proposing a realistic agential approach in the field of accounting. Our goal is to draw attention to the physical–intangible relationship. Not as two separate assets – each one achieving results by itself – but as a dynamic, intra-active process. Perhaps the tangible and intangible account classification is also a mere Cartesian mental habit (as stated by Barad in section 2.1). By relaxing this dualistic premise – moving away from the traditional sense of linearity and the binary dichotomy – one can understand, in an alternative way, the process of generating residual earnings. Making an analogy of this statement, Paton (1922, pp. 310–311) states that:

From the standpoint of the entire enterprise it might perhaps be said in the typical case that all assets are tangible. That is, if the entire left side of the balance sheet were viewed as a single account, “all assets”, there would be no good reason for excluding any one element more than any other; and there would be no good reason for considering this single account as an intangible property account. As soon as the attempt is made to isolate certain specific tangible properties, however, the intangible classification appears.

Our proposal regarding goodwill considers its coexistence with physical capital. In a going concern, the two wealth states coexist intra-actively, but are negatively correlated over time. This means that an increase in physical capital reduces intangible capital. This perception is complex, as intangible capital is continually renewed by new expectations around the company’s future performance. Therefore, when deciding during a business combination to pay an additional amount in the form of goodwill, the acquirer is anticipating a part of the residual profits that will be obtained in the future, when the transformation of goodwill into physical capital takes place.

In this sense, the amortisation approach results from the conversion of goodwill into physical capital, and not from the reduction of those intangible assets with indefinite useful lives. Acquirers anticipate such conversion, measuring future economic incomes at present value for the purposes of calculating goodwill. Then, when going “*back to the future*”, the company must amortise this goodwill as these changes occur. In case goodwill amortisation is again discussed as a possibility by international standard setters, it should be used to refer to the cost of goodwill paid as part of business combination, and not to the asset itself.

4. Concluding Thoughts

“Research is a process of learning and little will be learned if the dominant manner in which we investigate accounting begins with the answer already in hand” (Williams, 2009, p. 277). “Traditional” accounting research has been dominated by the belief that reality is objective and concrete; that is, that it exists independently of human beings and has a determined nature or essence – a physical realism – which is closely linked to the distinction often made between the subject and the object (Chua, 1986; Lukka, 1990; 2010; Bisman, 2010). Human nature is considered calculating and instrumentally rational, but essentially passive (Hopper & Powell, 1985). This theory-building exercise has addressed an alternative approach that seeks to explain the interaction between subject and object, mind and body, ideas and actions. Such an approach can contribute to a deeper understanding of the nature of goodwill. Theoretical approaches based solely on market and hierarchy are inadequate for the task of conceptualising the intangible nature of intellectual capital (O’Donnell et al., 2003), and consequently of goodwill.

Over time, the accounting community has investigated goodwill with a focus on intangible factors that contribute to the generation of abnormal future earnings, and not on the

physical process as these surpluses occur. In fact, confusion about the real nature of goodwill is firmly rooted in the literature, as evidenced by accountants' attention to valuation formulas rather than underlying assets (Curtis, 1983). Perhaps because of that, the rejection of accounting standards on goodwill is a common occurrence and the nature of goodwill remains poorly understood by most accountants (Ma & Hopkins, 1988). Understanding the nature and behaviour of goodwill is the first step towards advancing a consensus on the topic. As stated by Canning (1929, p. 44), "the analysis of the nature of things is a problem apart from the quantitative measurement of the same things, and must, in any sound statistical inquiry, or in any critical analysis of a statistical procedure, be dealt with first".

During the period when accounting rules determined the amortisation of goodwill, the prevailing discussion in the academic environment was "why amortise the capacity to generate residual income?" (Jennings et al., 1996; Henning, Lewis & Shaw, 2000). In other words, given that the nature of goodwill was understood – as it still is – as a good name and reputation, managerial capacity, intellectual capital, employee excellence, good relationships with suppliers, customer loyalty and so on, what evidence would support its amortisation? Prevalent to the present day, this view occurs because traditional accounting (and other social sciences) is based on the onto-epistemological separation of tangible and intangible assets, each exercising a separate role in pursuing a company's objectives (the Cartesian view). Consequently, accounting seeks to measure and account for the largest possible number of equity elements, and the residue, which is considered very difficult to individualise, is aggregated in the form of goodwill. Based on the approach proposed in this essay, we advocate that the acquired goodwill "becomes" physical capital and is renewed (or not) as new ideas, plans and strategies arise to feed the decision-making process. Therefore, if entanglement explains goodwill becoming physical capital, then that means that goodwill decreases as the physical capital increases in value.

By proposing goodwill as the intangible capital of organisations, we argue that the techniques, expertise, qualities and virtues of human actions are value drivers for physical capital. The actions of both (physical and intangible capital) are entangled in the process of generating residual income. When advocating goodwill as that intangible that resides in the ideas and plans of senior management not yet embodied in physical capital, it is argued that organisations are valued for what they think and are able to decide and put into practice. The intangible forces that characterise a particular company are elements that create its physical – real – wealth. Superior company performance can be attributed to a combination of uncertainty plus atypical insight from management. For the author, experiences need to be tried out in order to learn which ones will succeed and which will fail. Hence, when the results are accounted for, it means that "the shareholder has captured (some of) the value, positive or negative, of past decisions" (Demsetz, 1973, p. 3). We conclude, therefore, that the economic reality of an asset is agential. That is, it builds up (mattering) dynamically, in an intra-active process, according to the "quality" of its interrelationships with other assets and intangible forces and in each specific context.

Bloom (2005) states that perhaps the only common element among all definitions and discussions about goodwill is that it is classified as intangible, and not as tangible. The present essay highlights that this understanding may not be entirely correct. We point out that these forces are intangible only according to Cartesian mental habits. The Cartesian dualistic approach (Burrell & Morgan, 1979; Hopper & Powell, 1985) is abandoned in favour of the proposal of an epistemological (or even ontological) inseparability between both physical and intangible capital. Thus, in the going concern, physical capital does not exist without intangible capital, and vice versa. One exists in function of and for the other. One reveals the other. One renews the other. Physical capital and intangible capital are "entangled" to form the economic

value of a company. Analogously to Büscher and Veloso (2018), it is proposed that physical capital and intangible capital are two perfectly superimposed axes intra-acting in space and time. It is these intra-actions that reveal a company's economic value.

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