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Industrial Sustainability and the Circular Economy as Counterparts to the Self-referral Mechanics of Natural Law: Part I—A Theoretical Foundation

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

In Maharishi Vedic Science, the self-referral mechanics of Natural Law are considered fundamental to any complete understanding of nature's functioning, since Natural Law is understood to be the unmanifest (i.e., non-physical) home of all the laws of nature and the unbounded source of order and intelligence responsible for creating and guiding the physical universe. This proposition is recognizable in modern scientific theories of the 'unified field'. Moreover, the circular structure and self-referral loops of Natural Law are said to underlie and guide every level of a manifest hierarchy. Among the hallmarks of industrial sustainability are its emphasis on harnessing renewable energy and recycling principles, both designed to limit the impact of polluting activities on the environment and to improve commercial performance. To circumvent the so-called 'take, make, dispose' linear economic mentality of the past, contemporary industry has also begun embracing models of circular economy, in which materials and energy are circulated and cascaded through the economic system,

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with waste either minimized, reused or eliminated altogether. The self-referential nature of recycling and the cascading circularity of circular economies thus bear a *prima facie* similarity to how Natural Law is structured and functions in continuous self-referral loops.
For that reason, in this Part I of a two-part series of research papers, we explore the fundamental nature of industrial sustainability and circular economy, showing them to be counterparts to the self-referral feedback mechanism of Natural Law as described in Maharishi Vedic Science.

Keywords: Industrial sustainability; circular economy; Maharishi Vedic Science; self-referral; natural law.

1. INTRODUCTION

Maharishi Vedic Science is the systematic investigation and exposition of the Veda and Vedic Literature as taught by Maharishi Mahesh Yogi [e.g., 1,2], and incorporates a detailed analysis of the four Vedas—*Ṛik Veda*, *Sāma Veda*, *Yajur Veda* and *Atharva Veda*—and 36 aspects of Vedic Literature. This theoretical approach is accompanied by a range of technological applications supported by an international research effort associated with many of the world's leading institutions, with publications having appeared in journals such as *Scientific American*, *Science*, and *British Journal of Educational Psychology*.

Maharishi—founder of Maharishi Vedic University in Europe, Maharishi University of Management in the United States, and Maharishi Mahesh Yogi Vedic Vishwavidyalaya University in India—has re-enlivened a contemporary understanding of ancient Vedic knowledge in the context of modern science and has developed applications relevant to contemporary living. Maharishi's insights into the scientific nature of consciousness, knowledge, and the laws of nature contain not only the epistemological basis to explain and the experiential methods to subjectively and objectively experience and "know", the Veda and Vedic Literature [e.g., 3, pp. 160-169], but he has operationalized the principles needed for social welfare programs designed to achieve the sustainability goals identified by his Vedic Science [e.g., 4].

As a consequence of applying these principles and programs, Maharishi [1, p. 556] has predicted a sustainable future for mankind by pointing out that "the world is witnessing the signs of a new awakening in every field in the direction of fulfilment. Now is the time for the world to witness the full glory of life according to Natural Law—to experience the full dignity of life in peace, prosperity, and happiness, with enlightenment and fulfilment in daily life". It is his exposition of Vedic knowledge which forms the theoretical foundation upon which this paper is advanced. [The term "Natural Law" in this context should not be confused with "natural law" as it has been applied in the Western canon to legal philosophy, politics and human rights [e.g., 5].

At the core of Maharishi Vedic Science is the knowledge and experience of "Natural Law" (referred to in Vedic language as *Dharma* [धर्म], "that which upholds the universe", and *Purushottama* [पुरुषोत्तम], the "absolute ruler of the ever-expanding universe" [1, p. 30, p. 36]) because Natural Law is said to be the "home of all the laws of nature" responsible for physical manifestation, as well as the single source of unbounded intelligence and order in nature and in humans [1, p. 116]; Natural Law is therefore considered the most fundamental level of life, referred to by Maharishi [1, p. 4] as the "Unified Field of Natural Law". This viewpoint is not unfamiliar to the "unified field theories" of modern physics, which collectively describe the fundamental forces and elementary particles in nature as being united in a single, non-physical field of pure potentiality [6] (Heisenberg, 1984).It should be noted that unified field theories, such as quantum string theories, are related to a family of theories such as "Grand Unified Theories" [7] and "Theories of Everything" [8] advanced by contemporary physicists, however the unified field in physics is typically not ascribed the quality of self-awareness, although some theoreticians have identified it with pure consciousness [9].

In addition to aligning the traditional Vedic view with modern science, Maharishi [1 pp. 102-109] has provided analyses of the relationship between a) the Lagrangian of the unified field (i.e., the "most compact mathematical expression of the structure of the total potential of Natural Law"), b) the qualities of the unified field, c) the different aspects of the Veda and Vedic Literature, and d) his discovery of the Veda in human physiology (including how each aspect of the Veda and Vedic Literature, such as *Shikshā*,

Kalp, and *Vyākaraṇ*, is expressed in "the structure and function of the physiology of everyone" [1, pp. 122-160]). Maharishi [1, p. 102] has even pinpointed their collective relevance to "every area of national administration by the different ministries of the government". In his *Apaurusheya Bhāshya* or "uncreated commentary" of the Veda and Vedic Literature, Maharishi [1, pp. 414-417] has also identified the syllables (*Akshara*, अक्षर) and words (*Pāda*, पाद) of the first verse (*Sūkta*, सूक्त) of *Ṛik Veda* with the "64 fermionic degrees of freedom" intrinsic to the Lagrangian of the Superstring, and has analyzed different aspects of the Veda and Vedic Literature in terms of Superstring Field Theory, quantum cosmology, and cosmology to explain the "evolution of the material universe" [2, pp. 584-585, pp. 635-637].

According to Maharishi, the Unified Field of Natural Law, as a result of referring to and interacting with itself as a self-sufficient field of pure consciousness, is the non-physical source of all the dynamism, energy and organizing power that exists in the universe, and is therefore:

"that one element in nature on the ground of which the infinite variety of creation is continuously emerging, growing, and dissolving. The whole field of change emerges from this field of non-change, from this self-referral, immortal state of consciousness. The interaction of the different intellectually conceived components of this unified, self-referral state of consciousness is that all-powerful activity at the most elementary level of nature. That activity is responsible for the innumerable varieties of life in the world, the innumerable streams of intelligence in creation." [10, pp. 25-26]

Maharishi Vedic Science also addresses the core tenets of sustainability science. For example, Maharishi [4, p. 22] has identified and encouraged "a very intimate connection between the individual and the universe" and proposed that to make full and appropriate use of our environment "man must learn to live in harmony with nature" [11, p. 9]. At the core of his concern for society and the environment is the lack of balance and health in human and natural life, and the need to prevent problems and reduce pollution [1,3, pp. 297-300]. Earlier, Maharishi [12, p. 22] had stated that "the ecological ideal of total mutual support within the whole community is attainable on every level" through his Vedic Science because it "restores to everyone…the spontaneous ability to gain from and give to his environment maximum enlivenment", notwithstanding the fact that:

"apart from problems associated with energy and other vital natural resources such as various metals, man has also succeeded in devastating his environment in terms of flora and fauna, and entire lakes, rivers, and forests have become dealers of disease rather than refeshment, health and pleasure." [11, p. 9]

As part of a larger research program on Maharishi's exposition of the Veda and Vedic Literature and their relation to sustainability science, we have highlighted some of the main principles and practices of Maharishi Vedic Science as they pertain to sustainability [13], with specific reference to Maharishi's suggestion that humanity should "avert the danger which has not yet come" (*Heyaṃ duḥkham anāgatam*, हेयं दुः खमनागतम्, *Yoga Sūtra*, 2.16). We have also investigated Maharishi Vedic Science and global climate change [14], its relation to human development and capability [15], and its alignment to both the Jain ecological tradition [16] and Aboriginal and Torres Strait Islander and Māori environmental stewardship [17].

The term "sustainability" has attracted significant attention in recent years, and phrases such as environmental sustainability, sustainability accounting, urban sustainability, and sustainable development have become commonplace in social discourse. Even Pope Francis [18] has issued a Papal Encyclical on the environment in which he said "our common home is falling into serious disrepair….There are regions now at high risk and, aside from all doomsday predictions, the present world system is certainly unsustainable from a number of points of view, for we have stopped thinking about the goals of human activity" [18, VII:61, p. 44].

One aspect of sustainability science not yet fully developed is "industrial sustainability", which to date has mostly been concerned with manufacturing, engineering and industrial ecology [19, 20] and "cycling of embodied resources between sectors" [21]. However, in the last ten years the phrase has gained favor within industry and government, much of it due to research conducted on "eco-industrial parks" (EIPs) in China [22, 23] and in parts of Europe [24], which in turn has been driven by advances

in industrial ecology, industrial symbiosis and their relation to biological ecosystems [e.g., 25]. Matthews and Tan [26, p. 435] have also pointed out that while "Germany and Japan have made important advances in building recycling incentives into their industrial systems and sought competitive advantage from doing so, China is arguably taking the issue even further…through its pursuit of a circular economy".

Thus, a more fundamental examination of industrial sustainability, which had hitherto been mostly focused on improving process efficiencies and reducing waste, has resulted in a conversation around what is now called the "circular economy" (CE), an economic model in which inputs (i.e., natural resource portfolios) and outputs (i.e., wastes and spent or old products) are conceived as having an (almost) infinite life, with a focus on energy, water, materials recycling and waste management. However, the theoretical foundations of both industrial sustainability and its expression as CE have yet to be fully investigated (although George et al. [27] have begun the process in relation to what they call "polluting and recyclable inputs") and the relation of industrial sustainability and CE to Vedic knowledge has not been explored. In this Part I, we therefore consider whether the circularity of industrial sustainability and CE can be identified in the self-referral mechanics of Natural Law and whether Maharishi's description of self-referral can provide a theoretical foundation for them.

The paper is organised into three sections beyond this Introduction: the first examines the self-referral nature and structural levels of Natural Law as elucidated by Maharishi Vedic Science; the second considers the circularity of industrial sustainability and CE; and the third explores how the basic principles of industrial sustainability and CE mimic or closely resemble the self-referral mechanics of nature, and can thus be considered "counterparts" to Natural Law. Part II, which follows as a separate research study, presents alumina refinery residue, one of the world's largest and most problematic hazardous wastes, as an example of self-referral industrial processing and partnering in the context of sustainability and CE [28].

As a point of orientation, we use the term "industrial sustainability" to mean an industrial process, program, system or practice that can be maintained or kept going without depleting itself or damaging its surroundings (a worldview most often associated with industrial ecology in which industrial systems are embedded in natural ecosystems [29]), however we recognize that the term has many meanings when applied to different domains of theory and praxis.

2. SELF-REFERRAL STRUCTURE OF NATURAL LAW

Maharishi has stated that the purpose of investigating the "Vedic Structure" of Natural Law is "to establish it as that theory of administration which lays open the total administrative skill of Natural Law—the infinite organizing power of Natural Law, that is eternally administrating creation and its orderly evolution with the quality of automation, nourishing everything and everyone" [1, p. 234]. We take from this that Vedic Science is a science of sustainability, a science in which the administrative skill of Natural Law "eternally" upholds and nourishes everything in creation. Maharishi goes on to explain that "for any structure to be inexhaustible, it must be self-referral, which means it must refer to its source, it must refer to itself, it must be in a circular form" [3, p. 75]. Both industrial sustainability and CE aim to create a long-term, soteriological (e.g., "soul-saving") future using principles from nature [e.g., 25] and each contains elements of "circularity". This observation suggests to us there may be a relationship between the way Natural Law is structured and operates and the way both industrial sustainability and CE have been conceived and implemented.

We have established that one of the most basic premises upon which Maharishi Vedic Science is founded relates to the existence of an unbounded, field of pure consciousness, or pure intelligence, which is the source of physical creation. In Vedic language, pure consciousness is referred to severally depending on the context as *Ātmā* (आत्मा, the Self of everyone), *Turiya chetana* (तुरीय चेतन) or Transcendental Consciousness when in relation to human experience), *Yoga* (योग or the unified state of consciousness), and *Swayambhu* (स्वयंभू, pure existence or Being). Maharishi [2, p. 2] maintains that this absolute, non-changing level of pure consciousness is an "invincible continuum" and can be described as "one unbounded ocean of consciousness, one unbounded ocean of intelligence" [1, p. 4].

Having established the existence and character of pure consciousness, Maharishi [1, p. 2] goes on to point out that this field of "pure singularity" of intelligence is fully awake within itself and administers itself and physical creation while always remaining self-referral. This principle of silent administration through Natural Law is described by Maharishi as the "Principle of Least Action", by which the total potential of Natural Law, the home of all the laws of nature as we observe them operating silently throughout the universe, is the fundamental operating principle of nature's administration. Through its own "infinite organising power [Natural Law] administers the orderly evolution of all its diversified expressions in a perfectly integrated and balanced state" [1, p. 4]. In this sense, Natural Law, is the source of everything in creation, including human, social, environmental and industrial life, administering life not through action but through "least action", through what Maharishi calls "self-interaction" or "Self-Rule" [1, p. 3]. Thus, Maharishi locates the home of Natural Law in the unbounded, silent, unchanging, state of pure consciousness, and describes it as a "self-sufficient" [10, p. 26], eternal continuum of consciousness responsible for administering the universe.

Maharishi [1, p. 235] maintains that Natural Law is an eternal and absolute structure "because the total potential of its infinite organizing power is the field of intelligence which is an eternal continuum. Its self-referral nature is expressed in the structure of a circle. A circle can be big or small. It can be smaller than the smallest or bigger than the biggest. As long as it is a circle it represents a continuum". In the Vedic tradition, these circles are called *Maṇdala* (मडल), and Maharishi has pointed out that the same continuum of Natural Law.

"structured in the form of the DNA (likened to a small circle) in every cell of the body, is the same totality of Natural Law that has structured the whole human physiology (likened to a bigger circle), and it is the same totality of Natural Law that has structured the physiology of the ever-expanding universe (likened to the circle of infinite diameter)—the totality of Natural Law is expressed at every level." [1, p. 238]

In the Vedic Literature, this circularity of Natural Law is explained to be "smaller than the smallest [as well as] bigger than the biggest (*Aṇoraṇīyān Mahato-mahīyān*, अणोरणीयान् महतो महीयान्, *Katha Upanishad*, 1.2.20), and is therefore present at every level of creation.

Fig. 1 shows how Maharishi [30, p. 21] has diagrammatically represented the circularity of the different continuums of Natural Law. This image represents: 1) the "holistic value of Natural Law" (i.e., the non-physical, silent level of Natural Law) as a circle (left); 2) the different laws of nature, which structure material creation, as a series of smaller circles (centre); and 3) the entirety of Natural Law as it administers the universe, which Maharishi describes as a "wholeness" more than the mere collection of the specific laws of nature, as a series of circles within a circle (right). In Vedic language, the first is described as Dharma, Purushottama or Ātmā; the laws of nature in the second circle are severally called *Devas* (देव), *Ṛichas* (ऋच), or "frequencies of creative intelligence" [30, pp. 170 and 174]; and the third is called *Brahm* (ब्रह्म), the totality or wholeness of Natural Law [3, p. 225]. From Maharishi's perspective, these three continuums of consciousness are not separate one from the other, but rather represent "one WHOLENESS moving → to become another WHOLENESS" [30, p. 89] and account for the "uniformity of Nature" [1, p. 453]. The remainder of our analysis addresses these three structural levels of Natural Law.

Maharishi [1, p. 108] has referred to this threefold structure of Natural Law, and the infinite knowledge and organizing power it contains, as the "Constitution of the Universe" because it acts as a blueprint for all the laws of nature and every layer of material creation; he maintains that the circular and continuous nature of Natural Law can be attributed specifically to its "self-referral" property, to what he calls sequentially unfolding and simultaneous "feedback loops" [1, p. 472], of which an innumerable number exist throughout the universe.

Maharishi begins his more detailed examination of self-referral by explaining that the holistic home of Natural Law, being an unbounded field of consciousness is aware, awake. And what is it aware of? It is eternally aware of itself; it is awake to its own existence. In this state, pure consciousness is conscious of itself, and is therefore simultaneously the observer (the subjective knower or *Ṛishi* [ऋष] in Vedic language), the process of observation (the process of knowing or *Devatā*, देवता), and the object of observation (the known or *Chhandas*,

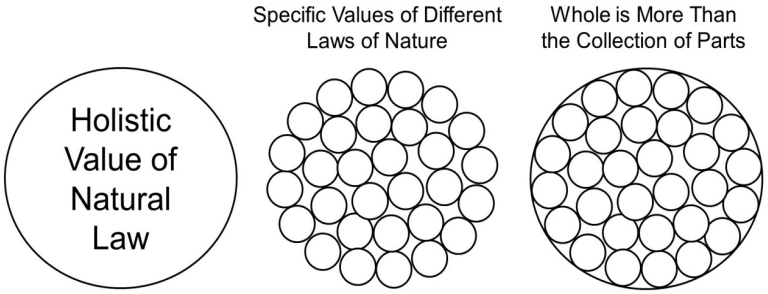

Fig. 1. The holistic value of Natural Law as a continuum (left); the specific values and circularity of Natural Law (i.e., different laws of nature, such as the strong and weak forces, gravitation, and electromagnetism) (center); and Natural Law maintaining its own identity while upholding all the specific values of different laws of nature throughout creation (right)

छदस) [31, p. 67]. Thus, consciousness, at the non-physical level of Natural Law, is both the subject and object of its own knowing; it is simultaneously a silent field of unadulterated Being, or pure existence, and a dynamic field of unbounded, self-referral consciousness, referring only to itself in a continuously circular motion. The self-referral relationship of Ṛishi, Devatā and Chhandas to each other can be seen in Fig. 2 (left) and refers to what Maharishi calls "the whisper of the unified field to itself", which he defines as "the Veda, the field of 'pure knowledge'" [10, p. 40].

Maharishi [1, p. 410] has located several descriptions of this phenomenon in the Vedic Literature, including the phrase "curving back upon my own nature, I create again and again; creation and the administration of creation are both a natural phenomenon on the basis of my self-referral consciousness" (*Prakṛitiṃ svām avashtabhya visṛijāmi punaḥ punaḥ bhūta-grāmam imaṃ kṛitsnam avashaṃ prakṛiter vashāt*, प्रकृतिं स्वामवष्टभ्य्ह विसृजामि पुनः पुनः भूतग्राममिमं कृत्स्नमवशं प्रकृतेर्वशात्, *Bhagavad-Gītā*, 9.8). In their unified state, the three conceptual features of Ṛishi, Devatā and Chhandas in the one unbounded field of pure consciousness are called Saṁhita (or "togetherness", संहत, [1, p. 358].

As shown in Fig. 2 (right), Maharishi explains that it is the dynamic relationship of these three aspects of knowledge interacting with each other and with their unified value in Saṁhita (what he calls the "self-interacting reality of nature" and the "three-in-one structure of pure knowledge" [10, p. 40]) that gives rise to the creative impulse of Natural Law to stir and express itself as the diverse laws of nature and subsequently as material creation [1, p. 358]. However, Maharishi [1, p. 359] hastens to point out "it is the Saṁhita quality of consciousness that holds the reins of all activity in the universe. Saṁhita, the fully self-referral consciousness, administers the universe". Thus, it is the "unifying", holistic value of Natural Law, not its conceptually "diversified" parts, which creates and administers creation. This structure of knowledge is called *Veda* (which Maharishi [32, p. 26] equates with the non-physical self-referral intelligence of Saṁhita), and the Veda is thereby understood

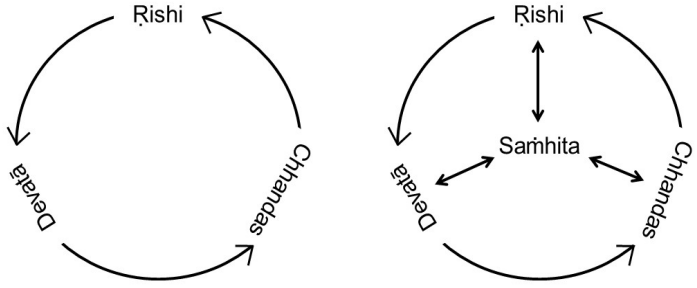

Fig. 2. The relation of Ṛishi, Devatā and Chhandas to themselves in a circular, continuous self-referral feedback loop (left), and in their togetherness as the Saṁhita of Natural Law, with each element interacting with itself and with each other (right) (Maharishi, 1986, p. 40)

to be "structured through [continuous] self-referral loops" [3, p. 44], which are "spontaneous fluctuations" within Natural Law. Every aspect of knowledge can therefore be conceptually identified as discrete while at the same time connected to unbounded consciousness, connected to the integrity and intelligence of Natural Law.

As Natural Law blossoms into more and more expressed aspects of creation, represented by an ever-expanding, physical universe governed by the laws of nature, each subsequent and elaborated expression of Natural Law simultaneously remains connected to its source in the Saṁhita of Ṛishi, Devatā and Chhandas, connected to (and integrated with) its source in the self-interacting dynamics of pure consciousness. Fig. 3 shows how Maharishi [1, p. 423] has schematically represented this "transformational" structure, showing that each level of expansion or elaboration of Natural Law remains eternally connected with the togetherness, or wholeness, of Natural Law in pure consciousness; in short, the self-referral structure of Natural Law is "bi-directional" because "at every point in the path, both directions are available" [1, p. 428]. Maharishi [1, pp. 164-171 and pp. 422-428] has even gone so far as to explain how each minute and infinitesimally small expression of Natural Law, as recorded in the Vedic Literature as a law of nature, is kept connected to its unmanifest source in pure consciousness through the gap between expressions. While a deep analysis of Maharishi's *Apaurusheya Bhasya* of the syllables, words, verses and chapters of *Ṛik Ved* is beyond the scope of this paper, it is worth noting that the "four fundamental qualities of Natural Law expressed in the Vedic Terminology as *Pradhwa- nsābhāva*, *Atyantābhāva*, *Anyonyābhāva*, and *Prāgabhāva* constitute the process of evolution, and [explain] the fundamental mechanics of one quality [transforming itself in]to the other" [1, p. 423] using the principle of self-referral. According to Maharishi [1, p. 37], Natural Law "eternally rules the universe with perfect order and without a noise". Thus, what Maharishi [2, p. 532] describes as the "dynamic structure of the total potential of Natural Law" is simultaneously the source, course and goal of all knowledge [2, p. 268], located at every point in an ever-expanding universe.

"This total potential of Natural Law", Maharishi [1, p. 236] explains, "is the pulsating, reverberating character of intelligence. It is consciousness in its unstructured state. Whatever we see in the observable universe is just an expression of the unobservable intelligence of Natural Law, which is the pure creative intelligence of the observer himself". (A more comprehensive description of the relationship between Natural Law and its expression into manifest creation using self-referral feedback loops from the perspectives of physics, chemistry, mathematics and physiology is located in reference 2 [pp. 154-422]. For example, self-referral feedback loops in the human physiology associated with the immune system, gene regulation and homeostasis are well documented.) Central to this analysis is the concept of progress or "evolution" as it relates to both material and human life. As we have discussed, according to Maharishi, Natural Law unfolds from within itself through self-referral loops, which in turn structure a "hierarchy" of "sequentially evolving processes of Natural Law, from unity [in its non-physical state] to diversity [in its expressed, physical state]" [2, p. 590].

This progressive development of Natural Law, or hierarchy of layers of Natural Law, establishes, according to Maharishi, "the theme of evolution of unmanifest to manifest through the twenty-seven clusters of self-regulatory processes [i.e., as recorded in the various sections of Vedic Literature], each with their divisions and

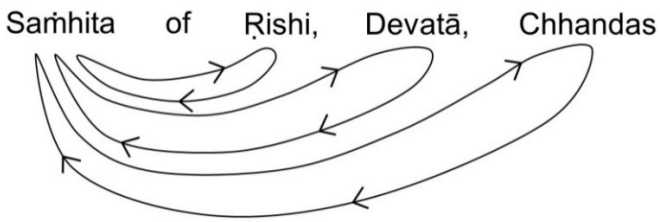

Fig. 3. Representation of how one unbroken field of Natural Law (Saṁhita) can be identified as Ṛishi, Devatā and Chhandas, while Ṛishi, Devatā and Chhandas remain connected at all times and at all distances, by their own internal self-referral mechanics, to the Saṁhita or togetherness value of Natural Law (Maharishi, 1994, p. 44)

sub-division—the self-regulatory processes that maintain dynamic equilibrium at every level of evolution, from the self-regulatory intelligence of the universe, to the self-regulatory intelligence of the galaxies, to the self-regulatory intelligence of the solar system, to the self-regulatory intelligence of the planet earth, to the self-regulatory intelligence of the individual, to the self-regulatory consciousness of the individual—the self-interacting dynamics of self-referral consciousness. The hierarchy of all these levels of evolution is available in the Veda and Vedic Literature, which is itself the structure of self-referral consciousness" [2, pp. 590-591].

These hierarchical structures or levels of Natural Law are schematically represented in Fig. 4 (left), which shows how the self-referral quality of Natural Law upholds the evolution of creation (*Vishva* [विश्व] or the universe). In this sense, all the natural and evolutionary processes of nature are self-referral and circular in character, each looping back onto itself while expanding and progressing toward fulfilment, simultaneously evolving in the direction of greater progress and achievement while all the time remaining self-sufficient and balanced in pure consciousness.

Fig. 4 (right) schematically shows how Maharishi represents the same phenomena from a different perspective. This deceptively simple diagram suggests all three levels of Natural Law, namely, the self-referral singularity of Natural Law as Saṁhita in the centre, the diversifying and dynamic expressions of the laws of nature emanating from within Saṁhita but always remaining connected to it in the arrows, and the realisation that both these phenomena are operating within a unified structure of self-referral as represented by the outer circle, which itself is a continuum of self-referral consciousness. It is this "unity in diversity" principle that Maharishi calls the "UNIverse—everything in the ever-expanding universe moving in unison—everything harmoniously related to everything else—everything the expression of the same eternal [Natural] Law" [1, pp. 239-240]. From this analysis, Maharishi concludes that Natural Law has a self-referral structure at every level of nature's operation: at the level of pure consciousness; at every level of the laws of nature; at the level of physical creation and the expanding universe; and at every point between and within the expansion of Natural Law from Ātmā to Veda to Vishwa.

In summary, Maharishi has identified and graphically represented a hierarchy of self-referral structures as described in the Veda and Vedic Literature. These have been summarised in Fig. 5. In this diagram, Maharishi represents the self-referral, singularity of Natural Law as a "point", described as a unified, silent field of pure consciousness. In Maharishi Vedic Science, the point is severally called *Kaivalya* (कैवल्य) or singularity, Yoga and Saṁhita. The diagram depicts the expansion and evolution of the laws of nature from this point as a series of ever-widening self-referral feedback loops, and indicates these loops expand to an infinite dimension, representing the self-referral structure of Natural Law at the cosmological scale. This phenomenon is what Maharishi [33, pp. 110-111] calls a "collapse" of all possible transformations from the silence of the point to the infinite dynamism of an expanded universe. Thus, as

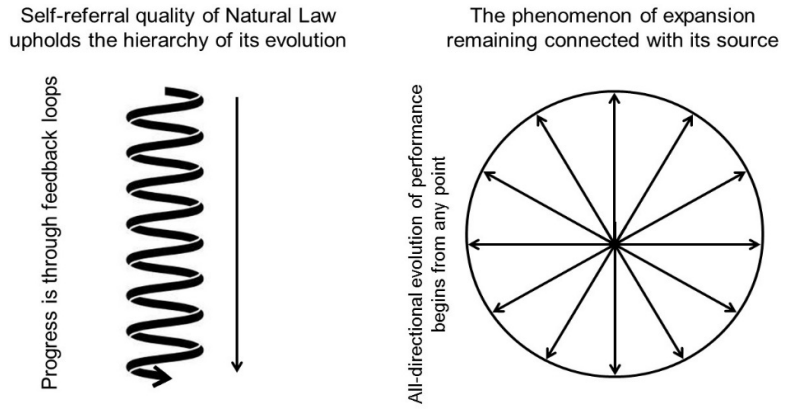

Fig. 4. The self-referral structure of Natural Law, operating eternally throughout creation, maintains its self-referral quality and connection to its source during the process of evolution (derived from [1, p. 592] left, and [1, p. 449] right)

stated above, Maharishi [30, p. 89] describes Natural Law as "one WHOLENESS moving → to become another WHOLENESS".

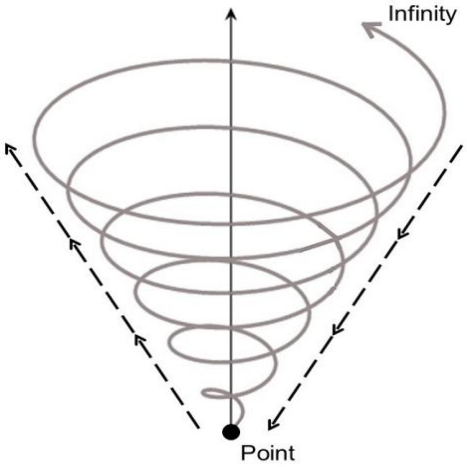

Fig. 5. The self-referral structure of Natural Law, operating eternally throughout creation, maintains its self-referral quality and connection to its source during the process of evolution or expansion from a point to infinity (derived from [33, p. 110])

However, Fig. 5 also shows that not only does the point expand to infinity, but the dynamism of infinity simultaneously collapses to a point, thereby representing the expansion of the point to infinity in self-referral loops, as well as the collapse of infinity to a point in ever-decreasing self-referral loops. At every point in the simultaneous expanding and contracting process, each aspect of Natural Law (identified initially as Ṛishi, Devatā and Chhandas) refers to and interacts with its unified self, with Saṁhita, the fully self-referral silent consciousness which "administers the universe" [1, p. 359] due to its self-referral character.

In Fig. 5 we can again identify the three basic levels of self-referral: 1) the non-physical level of Natural Law represented as a self-referral point or Kaivalya; 2) the different laws of nature, which structure material creation, unfolding in ever-increasing and continuous circles expanding to infinity; and 3) the "wholeness" of Natural Law as an expanding and collapsing self-referral structure—it is because of the "interchange between silence and dynamism within the nature of pure wakefulness [that] demonstrates the mechanics of creation; it explains how unity is duality and how the process of evolution is sustained within it" [3, p. 345]. This entire self-referral structure of Natural Law is called Brahm, the totality of Natural Law, and hence the Vedic Literature specifically declares that "the administrator [of the universe, i.e., Natural Law] is present in everything that he administers; the Creator is present in every grain of His creation (Tat sṛishtvā tad evānuprāvishat, तत्सृष्ट्वा तदेवानुप्राविशत्, *Taittirīya Upanishad*, 2.6.1).

According to Maharishi, this self-referral structure of Natural Law can be fully achieved on the individual and social levels through the Transcendental Meditation and TM-Sidhi program. "If this state of consciousness, or this state of nature's activity", Maharishi [10, p. 26] contends, "could be brought on the level of daily life, then life would naturally be as orderly and as full of all possibilities as is the nature of this self-referral state of consciousness". Thus, the Transcendental Meditation and TM-Sidhi program enables each individual, irrespective of educational, social or religious background, to effortlessly and naturally experience the unbounded, silence of pure consciousness, the source of both thoughts and the home of all the laws of nature.

For this reason, Maharishi states that "Transcendental Meditation is a MUST for anyone who wants to be self-sufficient in every way" [3, p. 353] and "fortunately, my Vedic Science and Technology provides not only detailed intellectual understanding of the Constitution of the Universe, but also a highly practical, scientifically validated technology to apply this most fundamental and powerful level of Natural Law for the benefit of mankind" [1, p. 83]. The result of applying this program to individual life is explained in the Vedic Literature as: My universe is my Self (अहं विश्वम्, Aham vishvam, *Taittirīya Upanishad*, 3.10).

Contemporary sustainability theory maintains that sustainable development is the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the resources and ecosystem services upon which humans, societies and economies depend [e.g., 34]. From Maharishi's perspective, the preferable end state of such development would be a world in which living conditions and natural resource consumption continue to meet human needs (i.e., progress or evolution on the level of Vishwa) without undermining the integrity and stability of the natural systems upon which they

rely (i.e., development always remains connected to the infinite reservoir of self-referral intelligence, to the integrity and holistic value of Saṁhita, which is the fundamental structure of Natural Law).

In this way, because Natural Law "administers its territory through its own nature—unified state of Natural Law and diversified state of Natural Law—and eternally holds together all diversified values—all the Laws of Nature always held together in their integrated state, creating and maintaining the infinitely orderly creation of the ever-expanding universe" [1, p. 7], human progress can be sustainably maintained. Such a condition is, in Maharishi Vedic Science, a state of health, a state of balance; imbalance and damage to resource portfolios result in waste, pollution and sickness. It could therefore be argued that a failure to achieve this goal results in an opposite, unsustainable outcome, namely the experience of "poverty in the midst of plenty" [34, p. 27] as a result of disconnecting human life (i.e., an unsustainable life resulting in "poverty") from its source in the abundance and infinite intelligence of Natural Law (i.e., the "plenty" to which Sachs refers).

Our contention is that an industrial and economic disconnection from Natural Law results in rapacious consumption and the generation of waste, particularly hazardous or polluting waste, whereas "in its self-sufficiency [Natural Law] promotes the absolutely orderly functioning of the unbounded field of intelligence" [1, pp. 6-7]. We now examine how the self-referral structure of Natural Law can be identified within industrial sustainability and CE, and consider how each can be seen as a counterpart to Natural Law.

3. INDUSTRIAL SUSTAINABILITY AND CIRCULAR ECONOMY

In order to overcome the fragmentation of diverse approaches to a sustainable future, the concept of "sustainability" has evolved in the last 15 years to become the discipline of "sustainability science" [e.g., 35]. This discipline has emerged as a result of concerns by scientists, politicians and the general public that there is "increasing evidence modern humans have already exceeded global limits on population and socioeconomic development, because essential resources are being consumed at unsustainable rates" [36, p. 6].

Industrial sustainability is the application of sustainability principles to industrial paradigms, processes, practices and systems. These include the management and use of fresh water, wastewater and energy, the supply of raw materials (particularly in light of limited or diminishing natural resource portfolios), and the redesign, repair or remanufacture of spent or old goods. Research has included the potential role of biotechnology in industrial sustainability [37], the relation of industrial sustainability to Chinese manufacturing [38], and the sustainability of solid residues generated by Canadian sawmills [19]. Given that industrial complexes play a role in the consumption of the world's natural resources, and is the leading source of waste generation and pollution throughout the world, it is reasonable to conclude, as Gaigajis and Angelakoglou [39, p. S92] have, that the industrial sector must "play a leading role in the transition towards a more sustainable society". Several elements of industrial sustainability utilize what can be called "self-referral loops", including the recycling of waste and spent or old products (e.g., recycling municipal plastic [40]) and the resue of waste and spent or old products in other closed-loop social applications (e.g. reusing plastic in construction materials, such as concrete [41] and in liquid fuels [42]).

As introduced in Fig. 6, a more recent analysis of industrial sustainability has centered around the principles and practice of CE, an economic model which aims to capture the hidden or lost "value" of society [43, 44] while reducing or eliminating "waste" [27]. The multiple values considered by the model, which are present but unrecognized in most social structures, include energy, water, waste, nutrients or materials embedded in "flows" which "cascade" through the industrial and municipal processes, systems and economies of the world [45]. CE has arisen to counter the so-called linear "take, make, dispose" economic model [46], which relies on cheap, easily accessible raw materials and non-renewable energy, both of which are reaching, or will reach, their physical limit. CE is, in contrast to the linear "market economic" paradigm [27], an alternative model that industries and governments throughout the world have begun embracing, not only because it is a better approach to the long-term sustainability of society and human life, but because it makes more commercial sense to economically recycle and reuse lost value, and to unlock potential value, if at all possible. Ghisellini et al. [46, p. 11] define CE succinctly as:

"a way to overcome the current production and consumption model based on continuous growth and increasing resource throughput. By promoting the adoption of closing-the-loop production patterns within an economic system [CE] aims to increase the efficiency of resource use, with special focus on urban and industrial waste, to achieve a better balance and harmony between economy, environment and society."

To this end, Stahel [43, p. 436] has identified three types of industrial economy; one unsustainable and two associated with CE purportedly sustainable. The first is the aforementioned *linear economic model* which "flows like a river", turning natural resources into base materials and products for sale through a series of value-adding steps. This type of economy is driven by what Stahel calls a "bigger, better, faster, safer syndrome—in other words, fashion, emotion and progress", and is "efficient at overcoming scarcity, but profligate at using resources in over-saturated markets" [43, p. 436]. The linear model was largely instigated by the Industrial Revolution and is closely aligned with modern capitalism rather than with traditional societies and economies. A linear economy uses natural resources, and thus contemporary economic models have been developed to limit or curb inputs (for example, Tonelli et al. [47] have proposed an industrial system which uses no more than 25% of current global natural resource input levels to counter the trend of increasing human use). By definition, linear models are however unsustainable, and generally cannot be described as "self-referral" in character because few, if any, systems loop back onto themselves, although some minor internal industrial processes (e.g., recycling caustic soda in an alumina refinery) may be described this way.

As shown in Fig. 6, a *circular economy*, on the other hand, is "like a lake" (and hence related to concepts such as "industrial ecology" [e.g., 48]). According to Stahel [43, p. 436], "reprocessing of goods and materials generates jobs and saves energy while reducing resource consumption and waste. Cleaning a glass bottle and using it again is faster and cheaper than recycling the glass or making a new bottle from minerals". Rather than being dumped, waste and spent or old products in CE are "collected and sold to the highest bidder". In this way, the model is conceived in terms of a continuum, a circle without end, as opposed to a river with a beginning (inputs, such as natural resources) and an end (outputs, such as products and waste). One of the cornerstone principles of CE is the use of renewable energy in industrial processing [49], itself a mostly self-sufficient, cyclical process. Stahel [43, p. 436] also presents a variation on CE which he calls the *performance economy*, because it "goes a step further by selling goods (or molecules) as services through rent, lease and share business models. The manufacturer retains ownership of the product and its embodied resources and thus carries the responsibility for the costs of risks and waste. In addition to design and reuse, the performance economy focuses on solutions instead of products, and makes its profits from sufficiency, such as waste prevention". Stahel cites the example of Michelin, which sells "tyre use 'by the mile' to operators of vehicle fleets. The company has developed mobile workshops to repair and regroove tyres at clients' premises and aims to develop products with longer service lives. Worn tyres are sent to Michelin's regional plants for retreading and reuse….Conventional waste management is driven by minimizing the costs of collection and disposal—landfill versus recycling or incineration. In a circular economy, the objective is to maximize value at each point in a product's life" [43, p. 436]. In these ways, both circular and performance economies are self-referral in character.

The Ellen MacArthur Foundation [50, p. 17] and Webster [44] have identified three fundamental principles of CE: 1) preserving and enhancing natural capital; 2) optimising resource yields; and 3) fostering system effectiveness. Principle 1) relates to carefully "controlling finite stocks and balancing renewable resource flows". Principle 2) circulates products, components and materials, using "tighter and inner loops whenever they preserve more energy and other value, such as embedded labour"; circular systems maximise "end-of-use…materials [i.e., waste and end-of-life products], extracting valuable…feedstocks and cascading them into different, increasingly low-grade, applications". And Principle 3) seeks to reduce damage to essentials, such as food, mobility, education and shelter, by managing externalities like water and pollution, the release of toxic substances, and climate change. By their very definition, CEs are self-referential; they refer to and interact with themselves in a continuous looping fashion, and every attempt is made to carefully control feedstocks, use renewable energy, extract as much value as possible from components and materials, and then reapply each of them throughout the industrial (or social) system or process, thereby reducing any

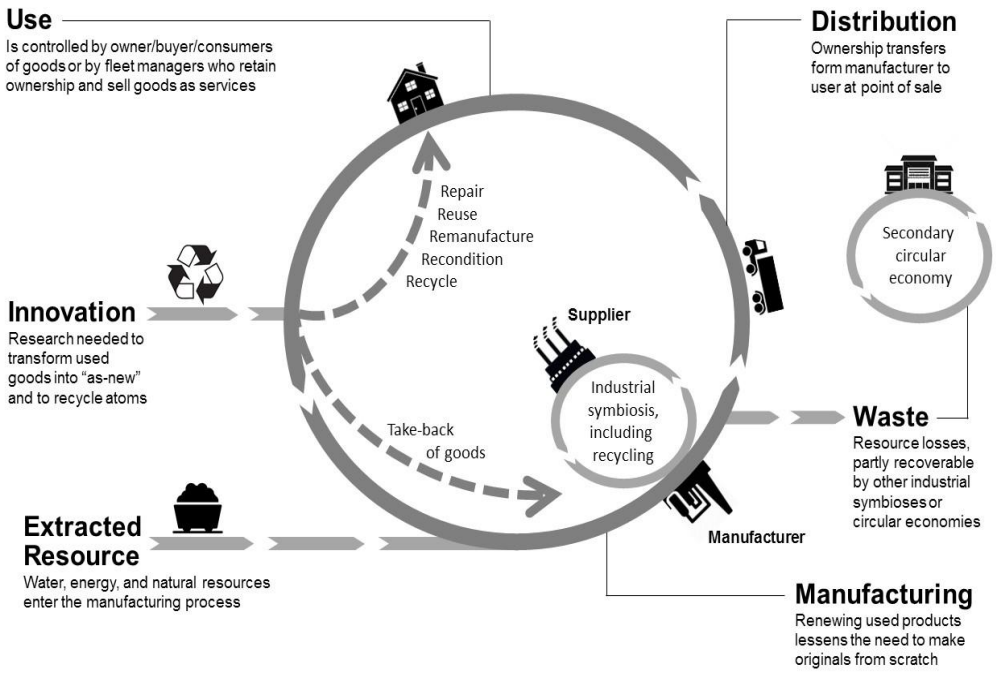

Fig. 6. Schematic representation of a circular economy [modified from 43, p. 436]

long-term damage to or decline in the environment and its natural resource portfolio. A focus of CEs can thus be described as a concerted move away from "consumption" to a focus on "use" and "reuse".

From this analysis, it becomes obvious that a cornerstone of CE is an overt and wilful attempt to "design out waste", a practice sometimes called the "waste-to-resource" initiative as applied to a variety of industrial applications, including the conversion of paper mill wastewater to bioplastics [51] and the production of methanol (CH_3OH) and dimethyl carbonate ($[CH_3]_2CO_3$) using carbon dioxide (CO_2) as a waste input [52]. Indeed, at the heart of many industrial sustainability practices are the principles of "reduce, recycle and reuse" [e.g., 53], which apply to the consumption of raw materials, energy, water, biomass, and so on. As shown in Fig. 7, according to this approach doing nothing with waste and continuing with the traditional take, make, dispose model are not options, as the Earth's resources are finite and the rate of consumption is increasing as populations and global consumer demands grow.

Moreover, *reducing* inputs and outputs is seen as a necessary, but not sufficient, first step in creating a sustainable future, hence, the need for the next step in creating a sustainable industrial future: *recycling*, in which wastes are returned to circuit and not disposed or discharged to the environment, an effort applied to paper, aluminium, glass and plastics in many societies [e.g., 54, 55]. Recycling is a self-referral process, since molecules and atoms are not lost to the environment but kept "in circuit".

However, for a variety of technical reasons most wastes cannot be returned to circuit, and therefore a beneficial *reuse* for waste must be sought in secondary or even tertiary processes and applications for industry to be more sustainable. For example, gaunge waste piles in China have been redirected from coal-fired power plants to EIPs for secondary power generation [56] and methods have been developed to recover and reuse phosphorus in a number of industrial applications [57]. Thus, reused "waste" has the potential through innovation to become part of and input to downstream economies beyond its orginal industrial process. In cases involving spent, abandoned or old goods, "reusing" products may include redesigning, repairing, reconditioning, remanufacturing or refurbishing goods and by-products and then recycling them through the economy, thus supporting self-referral material recovery and reuse.

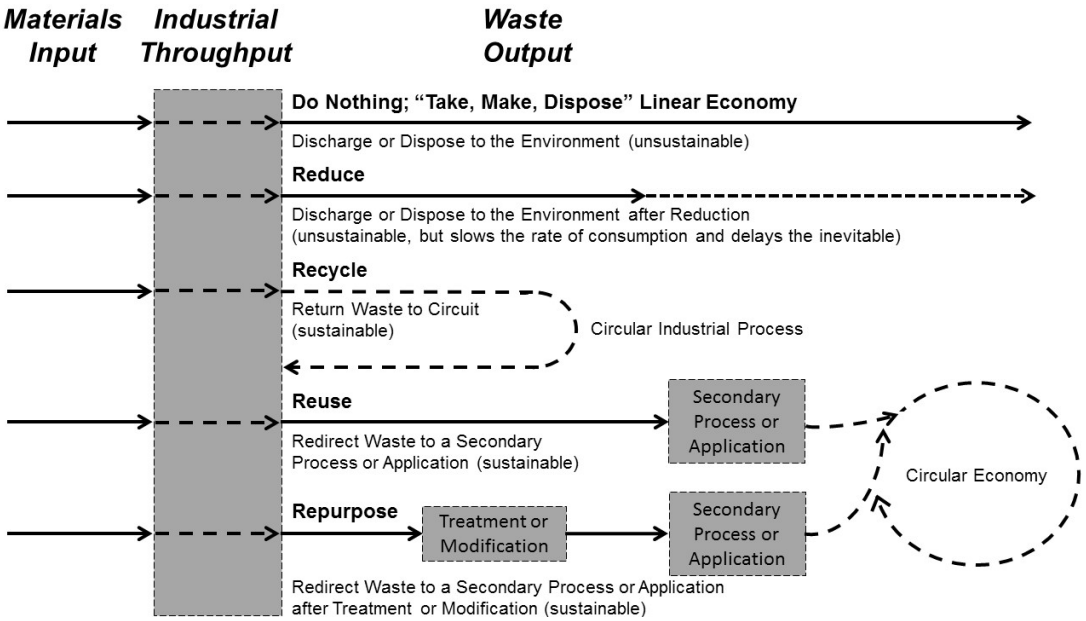

Fig. 7. Relationship between materials inputs, industrial throughouts and processes, and outputs under five waste management scenarios

Nevertheless, many industrial wastes cannot be reused because they are either too hazardous or, due to restrictive legislation or limitations associated with their "fit-for-purpose", unsuited to downstream re-application. However, even in these extreme cases wastes can be *repurposed* through the development and implementation of innovative treatment and modification processes, oftentimes provided by independent third-party technology providers. As a consequence, "value" can be liberated from the industrial process and a more sustainable future can be realised for even the most unwanted, unloved and rejected industrial gaseous, liquid and solid waste streams, including hazardous streams. Thus, in the same way that actual industrial waste can cause cancer and spread disease in society [58], so too in CE, industrial and municipal wastes can be seen as a "cancer" of the whole system (in the language of Maharishi Vedic Science, the "parts" of the system have become disconnected from the "wholeness" of the system, resulting in imbalance, disease and pollution [3, pp. 297-300]). Such is the case for one of the world's most hazardous industrial solid waste streams [e.g., 59] which, when re-conceived as part of CE involving information exchanges and cooperative industrial handshaking as shown in Part II of this research series [28], can be transformed from being a threat to society to being reconnected to the wholeness of Natural Law through the self-referral mechanics described in this paper. In these ways, all industrial wastes, including hazardous wastes, have the potential to be aligned with Natural Law and harness its self-referral mechanics, thereby creating balance rather than disease throughout society.

Maharishi would likely have endorsed CE because he presciently stated that "the all-pervasive imperatives of greed and desire to accumulate more and more wealth left no alternative other than to plunder nature. For a while, man even saw himself as the subduer of nature and treated nature's resources so ruthlessly that…he is faced with the collapse of society's political, social, economic and environmental structures" (World Government of the Age of Enlightenment, 1978, p. 9). He also pointed out the folly of generating energy via nucelar power, particularly as it relates to the "technological problems associated…with the storage of nuclear waste materials" [11, p. 9], which he contrasted with an economic model based on "the ground of eternal silence [in Natural Law]; that is why natural action does not create any strain. The energy consumed in activity is simultaneously replenished from its source in eternal silence, which is pure wakefulness, absolute alertness, pure subjectivity…self-referral state of consciousness" [1, p. 352]. In this example there is a clear synergy between the principles and practices of both industrial sustsinability and CE and

Maharishi Vedic Science, and as a result it can be proposed, as they occur at both the macro- and micro-levels of structure, industrial sustainability and CE have their roots firmly embedded in the self-referral mechanics of Natural Law.

4. SELF-REFERRAL NATURE OF INDUSTRIAL SUSTAINABILITY AND CIRCULAR ECONOMY

At the macro-level of economic design, CE has an evident self-referral character. Circularity occurs from the perspectives of renewable energy (e.g., solar power is both non-depleting, circular and continuous) and waste management (a topic to be examined in detail in Part II, but discussed here in the context of recycling). CE contrasts the linear trend of uncontrolled and consumption of natural resource portfolios at all costs, the disposal of waste to the environment, and discourages the use of nuclear technology as a viable long-term source of energy. CE, it can be argued, is thereby more in accord with Natural Law than some past industrial practices, due to its explicitly self-referral character and design for continuity.

Moreover, the return of goods to the manufacturer and the repurposing of goods by users (also called "upcycling") as a result of innovation have obvious self-referral properties. In such an economic model, products as well as waste are conceived in terms of cascading self-referral loops of reuse rather than simply consumed and discarded; everything in CE has value and nothing can be called "waste". In such a system, value is returned repeatedly to the macro-economic circuit in continuous, self-referral feedback loops (and hence CE is sometimes called "reverse logistics").

Perhaps most importantly, like Natural Law, CE is not simply a never-ending circle *per se*, but is designed to generate a spiral of sustainable economic growth (what Maharishi above called "evolution"), and in that sense is meant to create self-sufficency through multiple self-referral loops. It can also be argued that the entire functioning of CE at its macro-level is a series of circles, each referring to themselves and to each other in one sustainable totality, as posited and encouraged by Maharishi Vedic Science. For example, the economic structure of CE represents the "unified" or "holistic" value of the system—the Saṁhita or "togetherness" value of the system—whereas individual elements within the system constitute its diversified parts. These include inputs of raw materials, which could be deemed to represent the Ṛishi value of the system, with throughputs or those internal industrial processes which transform raw materials into products representing the Devatā value.

These industrial throughputs generate outputs in the form of products, and these could be said to represent the Chhandas value of the process. Products can then either be returned to circuit for recycling (i.e., referring back to the Ṛishi value) or can be redirected as a different input (i.e., a new Ṛishi value) into a secondary CE before or after repurposing. In this continuous self-referral structure of CE, as is the case with Natural Law itself, throughputs do not generate waste because outputs in CE are either returned to circuit or reused and old and spent products are redesigned, repaired, reconditioned, remanufactured or refurbished for later downstream beneficial reuse. In this way, total energy consumption is reduced or saved.

Clearly industrial recycling, independent of whether or not it is part of a more comprehensive CE model, is a form of micro-self-referential practice because the same atoms, molecules and raw materials are literally returned to circuit and reused for exactly the same purpose in a wholly self-referral manner; the self-interaction of atoms, molecules and raw materials also occurs within the industrial process. The same may be said of waste by-products and spent or old products in CE, because their atoms and molecules too are returned to the commercial and social circuit for later reuse (sometimes after repurposing). Industrialised examples of this can be seen in the reusing of municipal solid waste incineration (MSWI) bottom and fly ash as a raw material input for cement manufacture (although it has also be used as an energy source in secondary CE systems [e.g., 60]) and in the recovery and reusing of cobalt (Co), gallium (Ga), indium (In), tantalum (Ta), and raw earth elements, such as dysprosium (Dy) and neodymium (Nd), from flatscreen TVs and computer notebooks [61]; a mathematical model of how CE functions vis-à-vis returned products has also been developed [62].

We therefore propose it can reasonably be concluded that many features of industrial sustainability and CE mimic or reflect the self-referral structure of Natural Law, as described by Maharishi Vedic Science. This is true of the obvious circularity of recycling and the cascading

of value through CE, but can also be seen in how waste is reconceived as a resource in both industrial sustainability and CE. In fact, we would go so far as to argue that the principles and practices emerging in industrial sustainability science and CE represent what Maharishi has called a counterpart to Natural Law. The word "counterpart" indicates a "structural similarity and functional uniformity" of a practice, system or program with Natural Law. Such counterparts reveal "the meaning of the word universe—UNIverse—everything in the ever-expanding universe moving in unison—everything harmoniously related to everything else—everything the expression of the same eternal [Natural] Law" [1, pp. 239-240]. It is this feature of every diverse element within the UNIverse of industrial suctainability and CE being coordinated, valued, connected, and integrated into the unified system, be it natural, industrial or economic, which contributes to our conclusion.

This perspective would seem reasonable given the Vedic Literature, as cited above in *Taittirīya Upanishad* for example, states that the self-referral character of Natural Law is present in everything it administers, is present in every grain of creation. Thus, we suggest that if everything is an expression of the self-referral character of Natural Law, and Natural Law operates in a circular and continuous manner, then industrial practices like recycling, reusing and repurposing, and CE more generally, which clearly utilises self-referral operating elements, represent counterparts to the self-referral mechanics of Natural Law and are an expression of them.

5. CONCLUSION

In this paper, we have established the continuous circularity of Natural Law and explained its relation to material existence, and have proposed that the self-referral structure of Natural Law is largely absent from the non-circular, discontinuous and unsustainable linearity of the take, make, dispose economic mentality of the past because of what Maharishi calls its "all-pervasive imperatives of greed and desire to accumulate more and more wealth [which] left no alternative other than to plunder nature" [11, p. 9]. Moreover, we recognize that recycling in industrial sustainability and the self-referential nature of CE more generally reflect the first viable steps toward a greater use of, and alignment with, the laws of nature as embodied in the total potential of Natural Law.

From this we conclude that in the same way new modes of thinking about sustainability have evolved into more holistic, systems thinking about industrial practices and behaviour, so too sustainability science can reach out to other modes of thinking about biological ecosystems, human functioning, and other natural systems. To that end, an understanding of the self-referral mechanics of Natural Law represents a departure from industrial and CE practices, which simply identify value in waste and work toward a "waste-to-resource" future, might result in an engagement with the knowledge and experience of Natural Law to inform and guide society, industry and sustainability science, thereby leading to a soteriological outcome for humanity.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Maharishi Mahesh Yogi. Maharishi's absolute theory of government. Holland: Maharishi Vedic University Press; 1995.
2. Maharishi Mahesh Yogi. Maharishi's absolute theory of defence: Sovereignty in invincibility. India: Maharishi Vedic University Press; 1996.
3. Maharishi Mahesh Yogi. Maharishi Vedic University: Introduction. Holland: Maharishi Vedic University Press; 1994.
4. Maharishi Mahesh Yogi. Maharishi's master plan to create heaven on earth. Holland: Maharishi Vedic University Press; 1991.
5. Doe N. (Ed.). Christianity and natural law: An introduction. Cambridge: Cambridge University Press; 2017.
6. Heisenberg W. Introduction to the unified field theory of elementary particles. In W. Blum HP Dürr, Rechenberg H (eds.). Scientific review papers, Talks, and Books, Volume B of the series Gesammelte Werke/Collected Works. 1984;677-861. Wissenschaftliche Übersicht-sartikel, Vorträge und Bücher, Berlin and Heidelberg, Springer-Verlag.
7. Escultura EE. The grand unified theory. Nonlinear Analysis. 2008;69:823-831.
8. Laughlin RB, Pines D. The theory of everything. Proceedings of the National Academy of Sciences of the United States of America. 2000;97(1):28-31.

9. Hagelin JS. Is consciousness the unified field? A field theorist's perspective. Modern Science and Vedic Science. 1987;1(1):29-87.
10. Maharishi Mahesh Yogi. Life supported by natural law: Lectures by His Holiness Maharishi Mahesh Yogi. Washington, D.C.: Age of Enlightenment Press; 1986.
11. World Government of the Age of Enlightenment. A time of crisis: Environment. World Government News. 1978;9:5-13.
12. Maharishi Mahesh Yogi. Alliance for knowledge. West Germany: Maharishi International University Press; 1973.
13. Fergusson L, Wells G, Kettle D. Principles and practice of sustainability in Maharishi Vedic Science. Journal of Health and Environmental Research. 2016;3(3-1):1-15.
14. Wells G, Fergusson L, Kettle D, Bonshek A. Responding to climate change: The contribution of Maharishi Vedic Science. Journal of Health and Environmental Research. 2017;3(3-1):63-78.
15. Kettle D, Wells G, Fergusson L. Human development and capability: Reconstructed and fulfilled through Maharishi Vedic Science. Journal of Health and Environmental Research, 2017;3(3-1):78-89.
16. Fergusson L, Wells G, Kettle D. The personal, social and environmental sustainability of Jainism in light of Maharishi Vedic Science, Environment, Development and Sustainability. 2017b; 19:1-23.
17. Fergusson L, Kettle D, Wells G. Indigenous accounts of environmental stewardship in light of the theory and language of Maharishi Vedic Science. International Journal of Society, Culture & Language. 2017a;5(1):68-81.
18. Pope Francis. Encyclical letter laudato si' of The Holy Father Francis on care for our common home. Vatican, The Holy See, Rome; 2015.
19. Ackom EK, Mabee WE, Saddler JN. Industrial sustainability of competing wood energy options in Canada. Applied Biochemistry and Biotechnology, 2010;162:2259-2272.
20. Young W, Hwang K, McDonald S, Oates CJ. Sustainable consumption: Green consumer behaviour when purchasing products. Sustainable Development. 2010; 18;20-31.
21. Duchin F, Levine SH. Embodied resource flows in a global economy. Journal of Industrial Ecology. 2013; 17(1):65-78.
22. Boix M, Montastruc L, Azzaro-Pantel C, Domenech S. Optimization methods applied to the design of eco-industrial parks: A literature review. Journal of Cleaner Production. 2015;87:303-317.
23. Zhang H, Hara K, Yabar H, Yamaguchi Y, Uwasu M, Morioka T. Comparative analysis of socio-economic and environmental performances for Chinese EIPs: Case studies in Baotou, Suzhou, and Shanghai. Sustainability Science. 2009;4: 263-279.
24. Tessitore S, Daddi T, Iraldo F. Eco-industrial parks development and integrated management challenges: Findings from Italy. Sustainability. 2015;7: 10036-10051.
25. Leigh M, Li X. Industrial ecology, industrial symbiosis and supply chain environmental sustainability: A case study of a large UK distributor. Journal of Cleaner Production. 2015;106:632-643.
26. Matthews JA, Tan H. Progress toward a circular economy in China: The drivers (and inhibitors) of eco-industrial initiative. Journal of Industrial Ecology. 2011;15(3): 435-457.
27. George DAR, Lin BC, Chen Y. A circular economy model of economic growth. Environmental Modeling & Software. 2015; 73:6-63.
28. Fergusson L. Industrial sustainability and the circular economy as counterparts to the self-referral mechanics of natural law: Part II—a global case study. Open Science Journal. 2017;*2*(4):1-21.
29. Ashton WS. The structure, function, and evolution of a regional industrial ecosystem. Journal of Industrial Ecology. 2009; 13(2):228-246.
30. Maharishi Mahesh Yogi. Maharishi University of Management: Wholeness on the move. India: Maharishi Ved Vigyān Vishwa Vidyā Peetham; 1995.
31. Maharishi Mahesh Yogi. (1985). Maharishi Vedic University: Inauguration. Washington, D.C.: Maharishi Vedic University Press.
32. Maharishi Mahesh Yogi. Maharishi forum of natural law and national law for doctors. India: Maharishi Vedic University Press; 1996.

33. Maharishi Mahesh Yogi. Maharishi Vedic University: Exhibition. The Netherlands: Maharishi Vedic University Press; 1993.
34. Sachs JD. The age of sustainable development. New York: Columbia University Press; 2015.
35. Esteban M, Akiyama T, Chen C, Ikeda I, Mino T (eds.). *Sustainability science: Field methods and exercises*. Cham, Switzerland: Springer International Publishing; 2016.
36. Burger JR, Allen CD, Brown JH, Burnside WR, Davidson AD, Fristoe TS, Hamilton MJ, Mercado-Silver N, Nekola JC, Okie JG, Zuo W. The macroecology of sustainability. PLoS Biology. 2012;10(6), e1001345.
37. Bull AT. Biotechnology for industrial sustainability. Korean Journal of Chemical Engineering. 2001;18(2):137-148.
38. Zeng SX, Lui HC, Tam CM, Shao YK. Cluster analysis for studying industrial sustainability: An empirical study in Shanghai. Journal of Cleaner Production. 2008;16:1090-1097.
39. Gaidajis G, Angelakoglou K. Sustainability of industrial facilities through water indicators. Environmental Processes. 2016;3(Suppl 1):S91-S103.
40. Al-Salem SM, Lettieri P, Baeyens J. Recycling and recovery routes of plastic solid waste (PSW): A review. Waste Management. 2009;29:2625-2643.
41. Gu L, Ozbakkaloglu T. Use of recycled plastics in concrete: A critical review. Waste Management. 2016;51:19-42.
42. Panda AK, Singh RK, Mishra DK. Thermolysis of waste plastics to liquid fuel: A suitable method for plastic waste management and manufacture of value added products—A world prospective. Renewable and Sustainable Energy Reviews. 2010;14:233-248.
43. Stahel WR. Circular economy. Nature, 2016;532:435-438.
44. Webster K. The circular economy: A wealth of flows (2nd edition). Isle of Wight, United Kingdom: Ellen MacArthur Foundation; 2017.
45. Pollard S, Turney A, Charnley F, Webster K. The circular economy: A reappraisal of the stuff we 'love'. Geography. 2016; 101(1):17-27.
46. Ghisellini P, Cialani C, Ulgiati S. A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production. 2016;114, 11-32.
47. Tonelli F, Evans S, Taticchi P. Industrial sustainability: Challenges, perspectives, action. International Journal of Business Innovation and Research. 2013;7(2):143-163.
48. Newell JP, Cousins JJ. The boundaries of urban metabolism: Towards a political-industrial ecology. Progress in Human Geography. 2015;39(6):702-728.
49. Zhou ZY, Zuo J, Fan LL, Zillante G. Impacts of renewable energy regulations on the structure of power generation in China: A critical analysis. Renewable Energy. 2011;36:24-30.
50. Ellen MacArthur Foundation. Urban Biocycles. Isle of Wight, United Kingdom: Author; 2017.
51. Jiang Y, Marang L, Tamis J, van Loosdrecht MCM, Dijkman H, Kleerebezem R. Waste to resource: Converting paper mill wastewater to bioplastic. Water Research. 2012;46: 5517-5530.
52. Pongrácz A, Turpeinen E, Raudaskoski R, Ballivet-Tkatchenko D, Keiski RL. CO_2: from waste to resource for methanol-based processes. Proceedings of the Institution of Civil Engineers—Waste and Resource Management. 2009;162(4):215-220.
53. Barr S, Gilg AW, Ford NJ. Differences between household waste reduction, reuse and recycling behaviour: A study of reported behaviours, intentions and explanatory variables. Environmental and Waste Management. 2001;4(2):69-82.
54. Schmitz C. (Ed.) Handbook of aluminium recycling. Germany: Vulcan/Verlag; 2006.
55. Krivtsov V, Wäger PA, Dacombe P. Gilgen PW, Heaven S, Hilty LM, Banks CJ. Analysis of energy footprints associated with recycling of glass and plastic: Case studies for industrial ecology. Ecological Modelling. 2004;174:175-189.
56. Haibin L, Zhengling L. Recycling utilisation patterns of coal mining waste in China. Resources, Conservation and Recycling. 2010;54(12):1331-1340.
57. Cordell D, Rosemarin A, Schröder JJ, Smit AL. Towards global phosphorus security: A systems framework for phosphorus recovery and reuse options. Chemosphere. 2011;84:747, 758.
58. Wang J, Chen S, Tian M, Zheng X, Gonzales L, Ohura T, Mai B, Simonich SLM. Inhalation cancer risk associated

with exposure to complex polycyclic aromatic hydrocarbon mixtures in an electronic waste and urban area in South China. Environmental Science & Technology. 2012;46(17):9745-9752.
59. Fergusson L. Red mud futures: Repurposing one of the world's largest industrial waste by-products. Saarbrücken, Germany: Lambert Academic Publishing; 2015.
60. Pan JR, Huang C, Kuo JJ, Lin SH. Recycling MSWI bottom and fly ash as raw materials for Portland cement. Waste Management. 2008;28:1113-1118.
61. Buchert M, Manhart A, Bleher D, Pingel D. Recycling critical raw materials from waste electronic equipment. Freiburg, Germany: Oeko-Institut e.V; 2012.
62. Dat LQ, Linh DTT, Chou SY, Yu VF. Optimizing reverse logistic costs for recycling end-of-life electrical and electronic products. Expert Systems with Applications. 2012;39(7):6380-6387.

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