Economia Aziendale Online

Business and Management Sciences
International Quarterly Review

Holarchical Innovation Teams: Terms & Definitions

Michael F. Reber, Patrizia Gazzola

Pavia, December 31, 2022
Volume 13 - N. 4/2022

DOI: 10.13132/2038-5498/13.4.709-734

www.ea2000.it
www.economiaaziendale.it

PaviaUniversityPress

Electronic ISSN 2038-5498
Reg. Trib. Pavia n. 685/2007 R.S.P.

Holarchical Innovation Teams: Terms & Definitions

Michael F. Reber, PhD
Holarchical Innovation Teams Study Group, Tokyo, Japan

Patrizia Gazzola, PhD
Associate Professor,
University of Insubria,
Varese, Italy

Corresponding Author:

Michael F. Reber
Please email correspondences to hitsai2020@gmail.com

Or contact the Author via LinkedIn at:
https://www.linkedin.com/in/michael-f-reber/

Cite as:

Reber, M. F., & Gazzola, P. (2022). Holarchical Innovation Teams: Terms & Definitions. *Economia Aziendale Online, 13*(4), 709-734.

Section: *Refereed Paper*

Received: September 13, 2022
Published: 31/12/2022

ABSTRACT

This paper establishes the terms and definitions for the nascent discipline of Holarchical Innovation Teams (HITs). It provides a Review of Literature of those individuals who have contributed to our understanding of holarchies and who assist in creating an etymology for HITs in order to lay the foundations for subsequent papers on HITs philosophy and principles for future researchers and scholars of the discipline.

Questo lavoro statuisce i termini e le definizioni per la emergente disciplina degli Holarchical Innovation Teams (HITs). Fornisce una Review della Letteratura evidenziando gli studiosi che hanno contribuito alla nostra comprensione delle olarchie e che ci aiutano a creare un'etimologia per gli HITs per gettare le basi di successivi articoli sulla filosofia e sui principi degli HITs per futuri ricercatori e studiosi della disciplina.

Keywords: combinatory systems theory, creative kaizen, creative work, holarchy, holarchical innovation teams, holon, holonic network, innovation, organ, orgon, organization, orgonization, orgonic network, team

1 – Introduction

Since the days of ancient Sumeria (circa 4100 – 1750 BCE), humanity has known and constructed for itself the hierarchical social structure (Muscato, n.d., 5:49). Within the last sixty years, the holarchical paradigm has been emerging (Koestler, 1967; Capra, 1982; Wilber, 1995; Laszlo, 1996; Serguendo, Karageorgos, Rana, & Zambonelli, 2004; Brueckner, Serugendo, Karageorgos, & Nagpal, 2005; Edwards, 2009; Mella, 2009; Rudd, 2009; Collister, 2010; Serugendo, Gleizes, & Karageorgos, 2013; Robertson, 2015; Mella & Gazzola, 2017). Like all paradigm shifts (Kuhn, 1962/2012), the holarchical paradigm will one day supplant the hierarchical paradigm.

Already, many people are familiar with holarchies but do not realize they are living in a world of holarchies. In simplest terms, a holarchy is an organizational unit that is both a whole and a part. The human body is a whole of many parts, such

as molecules, cells, tissues, and organs. The Internet is a holarchy comprised of many nodes of websites and servers connected together in a digital web. Today, many of our daily activities would cease to function without this digital holarchy. The recent Pandemic has made it very real to people that we live in a world of holarchies as we have seen global supply chains come to a screeching halt (Berger, 2022).

Despite this universal awareness, humanity continues to work in hierarchies due to conditioning ourselves to *think and act* within the Industrial Revolution Paradigm (Reber, 2019c). This conditioning results in a dichotomy with current reality as illustrated in Figure 1.

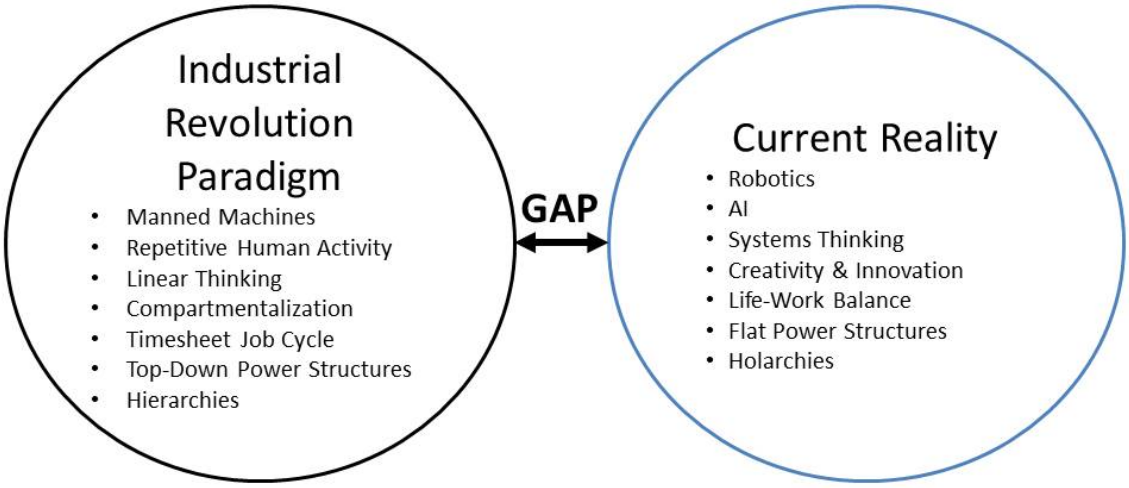

Fig. 1 – Industrial Revolution Paradigm vs. Current Reality (Reber, 2019c)

Within the Industrial Revolution Paradigm, we have grown accustomed to thinking that:

> machines are manned, human cognitive and manual activities are repeated, and job duties are packaged and task-oriented in definable job descriptions so as to maximize the application of Frederick Winslow Taylor's principles of scientific management (Reber, 2019c, p. 10).

However, in today's world, robots and artificial intelligence (AI) are replacing manned machines and repetitive cognitive activities ("Should We", 2022; Tita, 2022). Furthermore, since the mid-twentieth century, we have inculcated into several generations of young people linear-one-answer thinking toward problem solving that has created compartmentalization that in turn has established the mindset of "*That's not my problem. That's another person's problem*". To enforce this regime, time-motion economics is established. This requires a timesheet-job cycle management system, the clocking in and out on a fixed shift schedule, along with a top-down power structure where there are bosses and workers. This is similar to

> the power structure of the ancient Sumerians who were the first to institutionalize specialization, a division of labor, and a city-state system with structures from the lowly slave to the priest-king, distributing wealth and privileges according to class status (Reber, 2019c, p. 10).

However, today's *true reality* requires thinking systemically or *holarchically*. Holarchical thinking frees us

> from the bondages of monotonous human activity so we can apply our energies toward creativity and innovation (Reber, 2019c, p. 10).

By establishing creativity and innovation as the foundations for work, the need for freedom and holarchies is greater. To translate this into layperson's terms:

> Work systems include life-work balance that is centered on the individual, flat power structures that spur creative thinking, and holarchical organizational systems that embrace diversity in many forms (Reber, 2019c, p. 10).

This now brings us to the concept of Holarchical Innovation Teams (HITs). If people are to learn to work within Holarchical systems, they will also need to work in HITs. As we move further into the 21st century, a "holarchical work environment" will be required, and very different from the world of Frederick W. Taylor:

> People work together in an obligate mutualist symbiotic relationship. Job descriptions do not exist because repetitive tasks (manual repetitive and cognitive repetitive) are done by machines.
>
> Work…is human activity that makes a person whole. When an individual is doing the work that is one's to do in life, then the past, present, and future are all one. Wherever in time we might find a person in adolescent and adult life doing work, we should find that person living out life as one sees it should be lived out in accordance with the Principles of Creative Work. A person's past actions build upon the work of present actions and present actions build upon the work of future actions. This is what is meant by "the unity of a life"—Though an individual will never reach ultimate potential through the work that is one's to do, it is the journey to achieve that potential which defines an individual. The generally accepted notion is…***the journey is the purpose and meaning of one's life*** (Reber, 2019c, pp. 11-12).

Hence, *work*, in terms of both the "unity of life" and HITs, is a beautiful human expression of self-actualizing individuals who join self-actualizing teams which move from one innovation project to the next, up the competency and topic altitude and across the innovation topic spectrum. In theory, when one joins a HIT, she is matched with tasks or job roles commensurate with her abilities, interests, and personality traits. Furthermore, she receives from mentors and/or superiors the requisite encouragement, coaching, and direction to ensure the success of her value-creation. For example, let us assume Jane enters into the most basic of apprenticeships to design tea cups and saucers for the famous Wedgewood Company. In this apprenticeship Jane learns the fundamentals of design. As Jane improves in skill, she advances towards designing the most eloquent Wedgewood tea cups and saucers. When Jane reaches the most advanced level of design, Wedgewood *gives* her the option to move across the Wedgewood Topic Spectrum, such as to the Manufacturing Division. As Jane did not have any manufacturing experience, she learns the fundamentals of Wedgewood manufacturing and moves up the competency and topic altitude of the Wedgewood Manufacturing Division.

The implications of HITs and its organizational scheme are tremendous. First, HITs are considered *self-actualizing* organizational systems. Second, HITs dissolve the organizational dichotomies of Far/Close, Small Scale/Large Scale, and Inside/Outside. Both of these implications are of such import that they require subsequent papers for adequate attention. Therefore, since HITs is a nascent discipline, the purpose of this paper is to address the terms and definitions of HITs. The "Literature Review" circumscribes itself to those individuals whose contributions to the realm of holarchies benefit the discipline of HITs. After recognizing the antecedents of holons and holarchies, "TERMS & DEFINITIONS FOR HOLARCHICAL INNOVATION

TEAMS" establishes an etymology for HITs. This is vital to the subsequent papers on HITs philosophy and principles.

2 – Literature Review

The scientific community recognizes Arthur Koestler as the first person who formally introduced the concepts of Holon, Holarchy, and Holonic Network in *The Ghost in the Machine* (1967/1989). In terms of systems science and organizational studies, this has been followed by Ken Wilber (1995), Ervin Laszlo (1996), and Piero Mella (2009, 2017). For our purposes, we will restrict our Literature Review on the basic terms, definitions, and descriptions proposed by these authors since they are most relevant to the discussion on Holarchical Innovation Teams (HITs).

2.1 – *The Holon Defined*

In Chapter III - "The Holon" of *The Ghost in the Machine*, Koestler describes the holon as both a part and a whole. He states:

> A 'part', as we generally use the word, means something fragmentary and incomplete, which by itself would have no legitimate existence. On the other hand, a 'whole' is considered something complete in itself which needs no further explanation. But 'wholes' and 'parts' in this absolute sense just do not exist anywhere, either in the domain of living organisms or of social organisations. What we find are intermediary structures on a series of levels in ascending order of complexity: sub-wholes which display, according to the way you look at them, some of the characteristics commonly attributed to wholes and some of the characteristics commonly attributed to parts…. The members of a hierarchy, like the Roman god Janus, all have two faces looking in opposite directions: the face turned towards the subordinate levels is that of a self-contained whole; the face turned upward towards the apex, that of a dependent part. One is the face of the master, the other the face of the servant. This 'Janus effect' is a fundamental characteristic of sub-wholes in all types of hierarchies (Koestler, 1967/1989, p. 48).

Because Koestler acknowledges no satisfactory word in the vocabulary exists to describe this phenomenon, he coins the term *holon* which is derived from the Greek *holos* which means whole that includes the suffix *on* which means a particle or part of something whole, e.g. prot*on* (Koestler, 1967/1989, p. 48). In addition, he highlights examples of holons in life, such as organisms and human social structures. In terms of human society, he uses the term *social holon*, giving examples of great cities such as Paris and London (Koestler, 1967/1989, pp. 50-51). He states:

> Old towns like Paris, Vienna or London have their quartiers, each of them relatively self-sufficient, with its local shops, familiar cafés, pubs, milkmen and sweeps. Each is a kind of local village, a social holon, which again is part of a larger division—Left Bank and Right Bank, City and West End, amusement centre and civic centre, parks, suburbs. Old towns, not withstanding their architectural diversity, seem to have grown like organisms, and to have an individual life of their own (Koestler, 1967/1989, p. 51).

He uses the Home Office in the British Government as an example of a social holon and provides the following model (Figure 2).

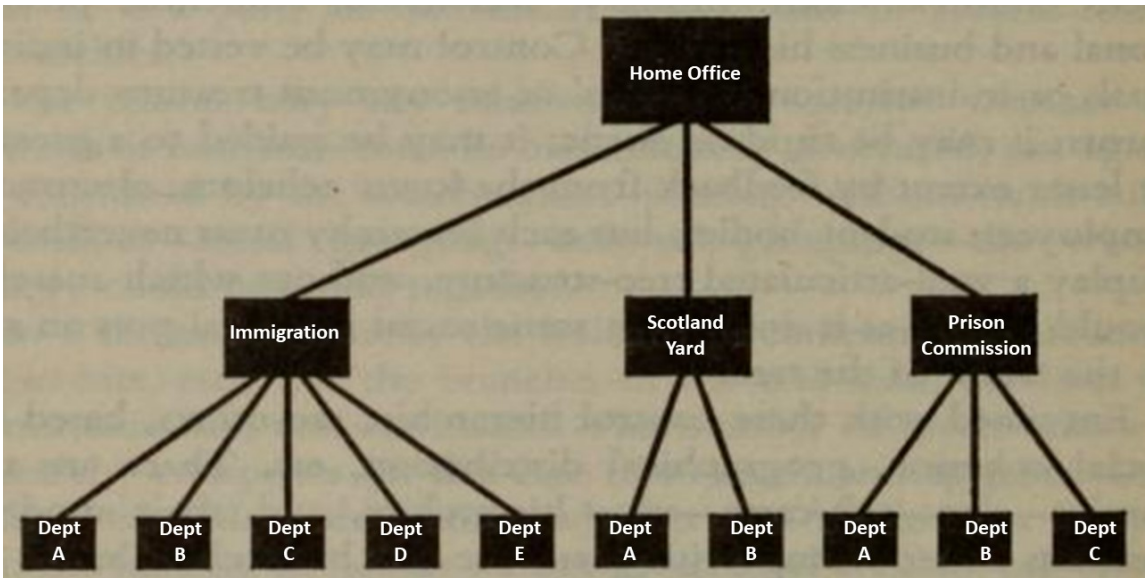

Fig. 2 – Koestler's Example of a Social Holon: British Home Office
(Koestler, 1967/1989, p. 52)

Each box represents a holon and each holon is given a specific identification based on the kind of function or task that has been assigned to it, i.e. the kind of work people do in that particular holon. Therefore, Immigration is responsible for immigration, Scotland Yard is responsible for policing, and the Prison Commission is responsible for prisons. Koestler compares office boys and telephones to "nerves and hormones" in the "control hierarchies of the living organism" (1967/1989, p. 53). Furthermore, he states:

> There is not only cohesion within each holon, but also separation between different holons to lend precision to the chart. The people who work within a given department transact much more business with each other than with people in other departments. Moreover, when one department requests information or action from another department, this is not as a rule done by direct person-to-person contact, but through official channels, involving the heads of each department. In other words, the lines of control run along the branches of the tree up and down; there are no horizontal short cuts in an ideal control-hierarchy (Koestler, 1967/1989, p. 53).

Koestler also comments that what makes a social holon a social holon is the pattern of *ruled-govern behavior* which is the shared traditions, such as laws and codes of behavior that in turn create group stability and social cohesion. It is these specific stable patterns that identify a social holon as a particular entity all of its own (Koestler, 1967/1989, p. 54). Furthermore, each social holon is identifiable to others through specific markers (Koestler, 1967/1989, p. 54). For example, a Scotland Yard police officer is distinguishable from a barrister by the uniform. Another attribute of the holon is that each holon operates as an autonomous, self-reliant unit:

> To repeat: it is essential for the stability and efficient functioning of the body social that each of its sub-divisions should operate as an autonomous, self-reliant unit which, though subject to control from above, must have a degree of independence and take routine contingencies in its stride, without asking higher authority for instructions. Otherwise the communication channels would become overloaded, the whole system clogged up, the higher echelons would be kept occupied with petty detail and unable to concentrate on more important factors (Koestler, 1967/1989, p. 55).

It is this *self-assertive tendency* that Koestler says is a "*fundamental and universal characteristic of holons, which manifests itself on every level of the social hierarchy*" (Koestler, 1967/1989, p. 56). In addition, each holon has an *integrative tendency* and the holon works towards an equilibrium between each of these tendencies (Koestler, 1967/1989, p. 56). This is the reason Koestler uses the term Janus-faced entity:

> No man is an island—he is a holon. A Janus-faced entity who, looking inward, sees himself as a self-contained unique whole, looking outward as a dependent part. His self-assertive tendency is the dynamic manifestation of his unique wholeness, his autonomy and independence as a holon. Its equally universal antagonist, the integrative tendency, expresses his dependence on the larger whole to which he belongs: his 'part-ness'. The polarity of these two tendencies, or potentials, is one of the leitmotivs of the present theory. Empirically, it can be traced in all phenomena of life; theoretically, it is derived from the part-whole dichotomy inherent in the concept of the multi-layered hierarchy…. [T]he self-assertive tendency is the dynamic expression of the holon's wholeness, the integrative tendency, the dynamic expression of its partness (Koestler, 1967/1989, p. 56).

Koestler summarizes the Janus Effect as follows in his General Principles of Open Hierarchical Systems (OHS) of Appendix I (Koestler, 1967/1989, p. 341):

1. The organism in its structural aspect is not an aggregation of elementary parts, and in its functional aspects not a chain of elementary units of behavior.
2. The organism is to be regarded as a multi-levelled hierarchy of semi-autonomous sub-wholes, branching into sub-wholes of a lower order, and so-on. Sub-wholes on any level of the hierarchy are referred to as *holons*.
3. Parts and wholes in an absolute sense do not exist in the domain of life. The concept of the holon is intended to reconcile the atomistic and holistic approaches.
4. Biological holons are self-regulating open systems which display both the autonomous properties of wholes and the dependent properties of parts. This dichotomy is present on every level of every type of hierarchical organisation, and is referred to as the *Janus Effect* or Janus principle.
5. More generally, the term 'holon' may be applied to any stable biological or social sub-whole which displays rule-governed behaviour and/or structural Gestalt-constancy. Thus organelles and homologous organs are evolutionary holons; morphogenetic fields are ontogenetic holons; the ethologist's 'fixed-action patterns' and the sub-routines of acquired skills are behavioural holons; phonemes, morphemes, words, phrases are linguistic holons; individuals, families, tribes, nations are social holons.

As it is unnecessary to go any further into Koestler's description of the holon, we can say that in addition to the Janus Effect he identifies nine other principles which include (2) Dissectibility, (3) Rules and Strategies, (4) Integration and Self-Assertion, (5) Triggers and Scanners, (6) Arborisation and Reticulation, (7) Regulation Channels, (8) Mechanization and Freedom, (9) Equilibrium and Disorder, and (10) Regeneration (Koestler, 1967/1989, pp. 342-348).

In addition to Koestler, Ken Wilber's *Sex, Ecology, Spirituality: The Spirit of Evolution* "is a book about holons—about wholes that are parts of other wholes, indefinitely" (Wilber, 1995, p. viii). At the end of this section, Table 1 provided by Mark Edwards in a *Brief History of Holons*

summarizes the distinction between Koestler and Wilber's explanation of the holon. Wilber describes the holon as:

> Whole atoms are parts of molecules; whole molecules are parts of cells; whole cells are parts of organisms, and so on. Each whole is simultaneously a part, a whole/part, a holon. And reality is composed, not of things nor processes nor wholes nor parts, but of whole/parts, of holons (Wilber, 1995, p. viii). In any developmental or growth sequence, as a more encompassing stage or holon emerges, it includes the capacities and functions of the previous stage (i.e., of the previous holons), and then adds its own unique (and more encompassing) capacities. In that sense, and that sense only, can the new and more encompassing holon be said to be "higher" or "deeper" (Wilber, 1995, pp. 20-21).

More specifically, we can say that a holon is (Mella & Gazzola, 2017, p. 5):

- ***Autonomous:*** "Possessing a function and dynamics that is distinct from the context"
- ***Viable:*** "Has a stable form that allows it to deal with environmental disturbances in order to survive"
- ***Independent (self-reliant):*** "Self-assertive tendency"
- ***Dependent:*** "While at the same time subject to some form of 'control' by the superordinate unit precisely because it has a role in the survival of the vaster structure it is contained in"
- ***Interactive:*** "Vertically linked to the superior and inferior units and revealing an *integrative tendency*; and…characterized by a canon of behavior that defines the constraints to action that the holon is subject to as a whole and as a part"

Piero Mella in *The Holonic Revolution* gives a mathematical description of the holon along with an illustration as shown in Figure 3.

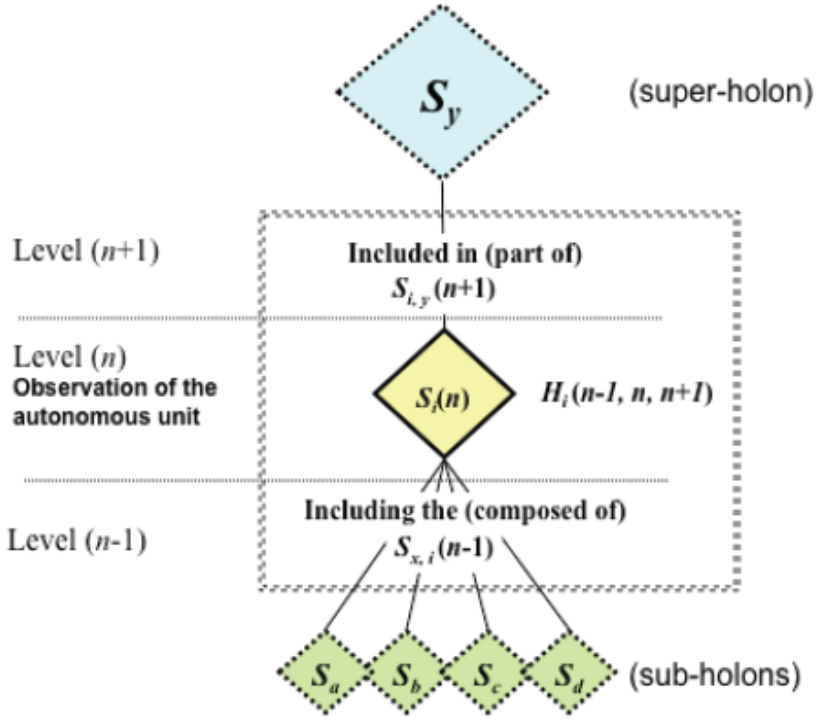

Fig. 3 – Holon H of the Structure S as Depicted by Piero Mella (Mella, 2009, p. 10)

Mella states:

> The holon does not correspond to any observational structure (observed or hypothesized). The holon is not the structure but of the structure, a center for the relationships with the other component, subordinate and composed, and superordinate structures (Mella, 2009, p. 10).
>
> If we let $S_i(n)$ be the *i*-th autonomous structure or system (or an object of observation), observable at the *n*-th level – and deriving from a *Technical Description…*– then we can view a holon H_i $(n - 1, n, n +1)$ as the *Technical Description of* S_i (n) integrated by the relations *Including* (composed of) the $S_{x,i}$ $(n - 1)$ – that is, all the structures *x* connected with the *i* of the level $(n - 1)$ and *included in* (composed of) $S_{i,y}$ $(n +1)$; in other words, the structure *y* of the level $(n+1)$ to which the *i*-th structure of the level (n) is connected; that is: H_i $(n - 1),n,n + 1)$ = *Including* $S_{x,i}$ $(n - 1)$ → S_i (n)→ *Included in* $S_{i,y}$ $(n +1)$ (ibidem).

Finally, Mella summarizes three functional interpretations of a holon (Mella, 2009, pp. 13-14):

a. *Modular* interpretation: the holon represents a module in a vertical ordering of other, vaster modules that contain it; holons at the same level are similar and, by means of some form of composition based on specific rules…, give rise to superordinate modules that are likewise similar (letters give rise to words, words to sentences, sentences to paragraphs, paragraphs to chapters, chapters to texts, etc.; quarks form protons, protons are holons for atoms; atoms are holons for molecules, etc.). The holons are uniquely and univocally defined, in terms of their structure and dynamic process, by their position, independently of what they represent and of how they operate.

b. *Cognitive* interpretation: the holon is viewed as an autonomous cognitive, sentient entity, and at higher levels of the holarchy as also equipped with awareness and consciousness. The holons of a given level are included in the superordinate holon that has cognitive capacities and autonomy, including those that characterize the component holons (microorganisms and living things from the vegetable kingdom are sentient holons; the holons represented by the animal kingdom possess awareness; the holons represented by human beings or by cognitively autonomous groups of human beings are conscious entities). This is the typical interpretation by Koestler, Wilber, Smith, and all those who use the concept to investigate the dynamic process of interconnected reality in ever wider o*bservational spheres*.

c. *Operative* interpretation: the holon embodies an *operator* or an *operation* involving processing carried out *in parallel*, characterized by its own inputs and outputs; it can be a biological individual, a machine, or even an entire organization. Holons from the same level process, by means of their own procedures, elements or information from subordinate holons and transmit the results to those at a higher level for further processing; the processes originate from those of the subordinate holons and, carried out in parallel, shape those of the superordinate ones.

Table 1. Mark Edwards's Table of the Correspondences Between Koestler's OHS Principles and Wilber's Twenty Holonic Tenets (the numbering is by the cited Authors)

Wilber's Twenty Tenets (see: Leonard, 2000; Smith, 2002)	**Koestler's OHS Principles** (Edwards takes direct quotes from The Ghost in the Machine)
1: Reality can be seen in terms of an endless series of holonic relations	1.3 Parts and wholes in an absolute sense do not exist in the domain of life. The concept of the holon is intended to reconcile the atomistic and holistic approaches. "The [holarchy] is open-ended in the downward, as it is in the upward direction"
2a: Holons have agency, individuality, deep autonomy.	4.1 Every holon has the ... tendency to preserve and assert its individuality as a quasi-autonomous whole; 9.2 the holon's agency is that which controls the part from the next higher level.
2b: Holons have communality, mutuality, and collective relationships	4.8 The canon of a social holon represents not only constraints imposed on its actions, but also embodies maxims of conduct, moral imperatives and systems of value.
2c: Holons have a capacity for self-transcendence, and active transformation into greater wholes	5.6 A holon on the n level of an output-hierarchy is represented on the (n+ I) level as a unit, and triggered into action as a unit. A holon, in other words, is a system of relata, which is represented on the next higher level as a relatum.
2d: Holons have a capacity for self-immanence, and the active integration of its parts	4.1 Every holon has the tendency to function as an integrated part of an (existing or evolving) larger whole. 4.1 A holon's Integrative (INT) tendencies are inherent in the concept of hierarchic order and a universal characteristic of life. The INT tendencies are the dynamic expression of the holon's partness.
3: Holons emerge creatively and indeterminately	8. Holons on successively higher levels of the hierarchy show increasingly complex, more flexible and less predictable patterns of activity, while on successive lower levels we find increasingly mechanised stereotyped and predictable patterns.
4: Holons emerge holarchically, i.e. through dynamics between hierarchy and heterarchy	6.1 Hierarchies can be regarded as 'vertically' arborising structures whose branches interlock with those of other hierarchies at a multiplicity of levels and form 'horizontal' networks
5: Each emergent holon transcends but includes its predecessors	"A hierarchy of holons should rightly be called a holarchy"

8: Each successive holon level within a holarchy produces greater depth and less span	2.2 The number of levels in a hierarchy is a measure of its "'depth", and the number of holons on any given level is called its "span".
12a: Evolution displays increasing complexity	8.4 Each upward shift is reflected by a more vivid and precise consciousness of the ongoing activity; and, since the variety of alternative choices increases with the increasing complexity on higher levels, each upward shift is accompanied by the subjective experience of freedom of decision. ("We find [holons] in an ascending order of complexity")
Holarchies possess interiority and consciousness	8.6 Consciousness appears as an emergent quality in phylogeny and ontogeny, which, from primitive beginnings, evolves towards more complex and precise states.

2.2 – *The Holarchy Defined*

In addition to coining the term holon, Koestler introduces the term *holarchy* which is a hierarchy of holons:

> To sum up...in a formula, we may say that the organism in its structural and functional aspects is a hierarchy of self-regulating holons which function (a) as autonomous wholes in supra-ordination to their parts, (b) as dependent parts in subordination to controls on higher levels, (c) in co-ordination with their local environment (Koestler, 1967/1989, p. 103).

Wilber agrees with Koestler in regards to his explanation of holarchy:

> It is for all these reasons Koestler, after noting that all hierarchies are composed of holons, or increasing order of wholeness, pointed out that the correct word for "hierarchy" is actually holarchy (Wilber, 1995, p. 21).
>
> He is absolutely correct, and so from now on I will use "hierarchy" and "holarchy" interchangeably (ibidem).
>
> Thus, heterarchists, who claim that "heterarchy" and "holism" are the same thing…, have got it exactly backward: The only way to get a holism is via a holarchy (ibidem).
>
> When I use the term "holarchy," I will especially mean the balance of normal hierarchy and normal heterarchy…. "Holarchy" undercuts both extreme hierarchy and extreme heterarchy, and allows the discussion to move forward with, I believe, the best of both worlds kept firmly in mind (Wilber, 1995, p. 24).
>
> But here is my point: if frameworks are inescapable (we are contexts within contexts, holons within holons), and if frameworks involve qualitative distinctions—in other words, if we are inextricably involved in judgments that are hierarchical—then we can begin to consciously join these judgments with the sciences of hierarchy, that is, the sciences of holarchy, of frameworks within frameworks, of contexts within contexts, of holons within holons—with the result that values and facts are no longer automatically divorced (Wilber, 1995, p. 30-31).

In addition to Koestler and Wilber, Ervin Laszlo defines holarchy as:

> multi-level flexibly coordinated structures that act as wholes despite their complexity…[with] many levels…[of] integration" (Laszlo, 1996, p. 51).

Holarchies exist everywhere, such as in society and biology. In society, a holarchy is comprised of people, job roles, departments, groups, and ultimately the organization. In biology, a holarchy is comprised of molecules, cells, tissues, organs, and ultimately the human body. Figure 4 illustrates a holarchy for the human body.

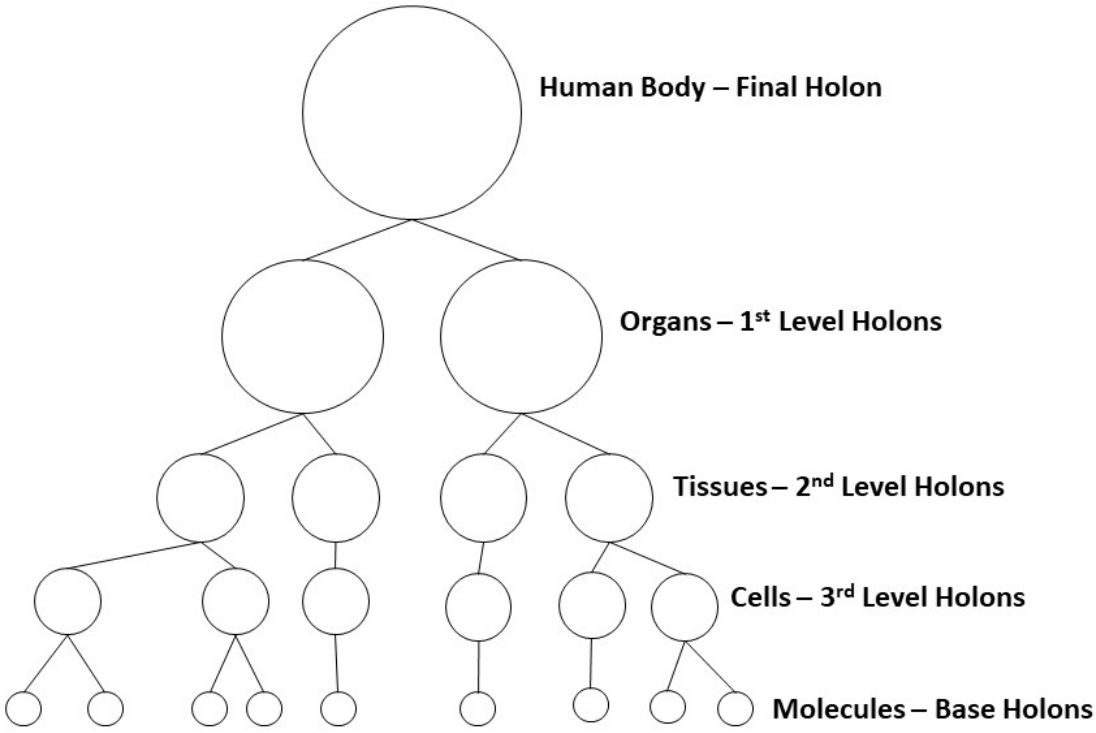

Fig. 4 – Example of Holarchy for Human Body

It is important to remember that within a holarchy exists the *base* holons and the *final* holon. Mella states:

> By definition the fact of being a double-headed Janus…implies that holons must necessarily be included in other holons in a typical vertical arrangement, with progressive accumulation and forming a nested hierarchical order called a holarchy, which can be represented as an arborised structure (turned upside down to fit this particular context) whose branches become larger at each successive hierarchical level (Mella, 2009, p. 17).
>
> Each holon becomes a head holon for the subtended branch and a member holon for the upper part of the branch it forms (ibidem).
>
> In formal terms the holarchies begin with the lowest level holons—the primal or base holons—and end with the highest level ones—the final or top or vertex holon. They interconnect with the environment and by definition are open (ibidem).
>
> Because of the typical whole/part relation, each holon is connected to the higher level—containing—and the lower level—contained—ones, but not with those at the same level…. Thus, holons from the same level can only interconnect through the higher level

> holon. Horizontal relations are not considered in Koestler's model (even if some form of horizontal interaction is admitted in Wilber's conceptual framework), even though there is the implicit possibility for cognitive and operative holons to interact with their own micro environment… and thus to observe holons from the same level (Mella, 2009, p. 17-18).

In Figure 4, the base holons are the molecules. Regardless of the molecules location in the human body, the molecule holons are on the same level. Molecules make up the cells, and we designate the cellular level as the third level. The tissues are comprised of cells and the tissue level is the second level holons. Organs are made of tissues and the organ level is the first level holons. Finally, together, the body is comprised of all the levels below it to function as a living organism.

As with holons, three basic types of holarchies exist:

a. *Modular or Structural Holarchies:*

> Consider holons as modules that are ordered based on qualitative and structural characteristics and on the similarities of genus and species…included in this class are modular and fractal holarchies and the systems of classification, whose aim is to identify a succession of classes, each of which possesses increasingly specific properties; the process that determines production costs through the gathering and gradual accumulation of elementary costs into autonomous categories…is a typical holonic classification system (Mella & Gazzola, 2017, pp. 7-8).

b. *Cognitive, Self-Organized Holarchies*:

> Composed of sentient, individual and social holons considered as autonomous 'cognitive entities' interconnected by relations or programming, coordination and control (Mella & Gazzola, 2017, p. 8).

c. *Operational Holarchies*:

> Derive from the arrangement of holons—sentient or artefacts—considered as 'processors', 'processes' or 'models of processes', interconnected to form increasingly larger operational structures through their inputs and outputs (Mella & Gazzola, 2017, p. 8).

Mella and Gazzola (2017, p. 8) state that Koestler's OHS and Wilber's *Kosmos* are examples of this.

2.3 – *The Holonic Network Defined*

Mella and Gazzola state that a holonic network is when a "holon maintains its features as a conceptual entity characterized by unity, autonomy and interiority; it behaves like a whole that is part of a *horizontal systemic network* of relations (with holons of the same level)" (Mella & Gazzola, 2017, p. 13). In addition, they assert that holonic networks are not holons:

> It is important to note that, like holarchies, the holonic networks are not holons but conceptual entities—horizontal or grid systems—whose nodes are holons which are interconnected according to their nature as entities and whose meaning comes only from their important horizontal interactions that contribute to forming a whole: the holonic network (Mella & Gazzola, 2017, p. 13).

Furthermore, they identify the advantages of holonic networks that are not considered by Koestler and Wilber:

> Far/close: the first advantage of thinking in terms of networks is that we get rid of 'the tyranny of distance' or proximity; elements which are close when disconnected may be infinitely remote if their connections are analyzed; conversely, elements which would appear as infinitely distant may be close when their connections are brought back into the picture (Mella & Gazzola, 2017, p. 13).
>
> Small scale/large scale: the notion of network allows us to dissolve the micro- macro distinction that has plagued social theory from its inception. The whole metaphor of scales going from the individual, to the nation state, through family, extended kin, groups, institutions etc. is replaced by a metaphor of connections. A network is never bigger than another one, it is simply longer or more intensely connected (ibidem).
>
> Inside/outside: the notion of network allows us to get rid of a third spatial dimension after those of far/close and big/small. A surface has an inside and an outside separated by a boundary. A network is all boundary without inside and outside. The only question one may ask is whether or not a connection is established between two elements (ibidem).

2.4 – *Organ & Organization, Orgon & Orgonization Defined*

Mella states that the "notion of organization corresponds to the more general one of organized system formed by human elements, or their groupings, that function as organs" (2009, p. 53). Furthermore, he asserts that "'Reality' can also be observed from a different perspective, that of the *organization*, understood as a *social system* that forms when a group of individuals (the personnel structure) accept, based on their own *motivations*, to become organs, or components of organs – specialized according to *functioning*, *function*, *functionality* and spatial-temporal *placement* – of a larger structure, becoming members of the latter in order to achieve a *common goal* that cannot be attained by the single individuals or by partial systems" (Mella, 2009, p53-54).

Mella also puts forth the new term "orgon" and defines an orgon as

> an organization-holon that, in turn, is a constituent member of a larger holonic organization, that is a holarchy of organizations (Mella, 2009, p. 64).

An orgonization is a "larger holonic organization of orgons" (ibidem).

A simple example of this would be a *company* (orgon) that belongs to a *group of companies* (orgonization). Mella states that

> the social and economic reality does not consist solely of individual holons and social holons but also of holons that are holonic organizations and, perhaps to an even greater extent, orgonizations, representing a new species of holon that comes about through a functional integration of the holonic organizations (Mella, 2009, p. 64).

Figure 5 is Mella's illustration of orgons and an orgonization.

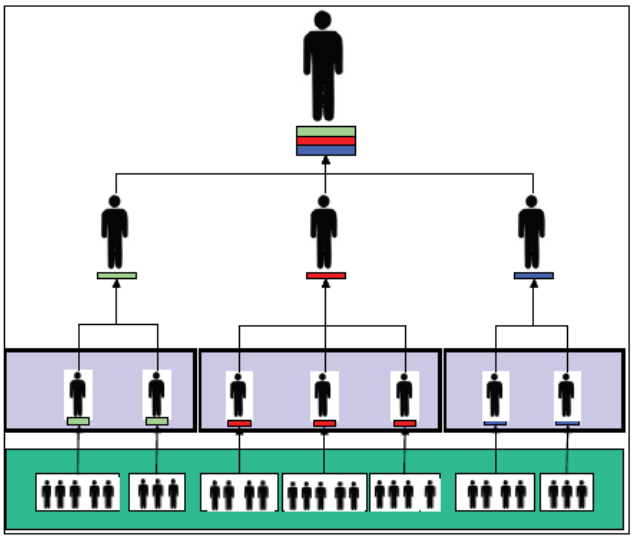

Fig. 5 – Orgonization as Depicted by Mella (Mella, 2009, p. 64).
(The underlined icon indicates an organization; in all other cases a primal holon)

Mella presents a list of some distinctive differences between Organs and Orgons (Mella, 2009, pp. 65-66):

a) From a structural point of view, organs are constituent, intrinsic parts of the organization. Orgons, on the other hand, as individual holonic organizations, participate in the orgonization but are autonomous in relation to it.

b) Genetically, organs are generated with the organization and by the organization; orgons, on the other hand, being autonomous, can themselves generate the orgonization through the annexation of other orgons.

c) The functioning (structure, processes, flows) of organs is thus dependent and hetero-directed by superordinate organs. The functioning of orgons is self-directed and only coordinated by the organization.

d) Organs have a *reflex vitality* since their existence, their number and their articulation depend on the vital needs of the organization. Orgons are only coordinated by superordinate orgons and have an autonomous vitality.

e) Organs are functional for the organization; the orgonization is functional for the orgons it coordinates. The operativeness of the organs is based on their functionality. That of the orgons is centered on their function.

f) The spatial and temporal collocation of the organs is decided by the organization and represents one of their defining intrinsic dimensions. The orgons decide their localization autonomously, which moreover does not substantially affect the orgonization's functionality.

g) The cessation of the organization usually leads to that of its organs; the autonomy of the orgons means that they are vital even after the orgonization ceases to exist. The orgonization is more robust than the organization.

h) The autopoiesis of the organs depends on the organization. For the orgons autopoiesis is a necessary condition for participating in the organization.

i) The organs' competencies are established by the organization. Those of the orgons are set autonomously and represent a condition for their participation in the organization.

j) The resources necessary for the functioning of the organs come from the organization, which "capitalizes" the organs based on their need. The capitalization of the orgons is based on the objectives and is normally autonomous and exogenous.

k) The primal holons that compose an organ also compose the organization and are recruited by request of the organ, according to need. The primal holons in the orgons are recruited based on objectives; they only make up the orgon, not the organization.

2.5 – *Holonic and Orgonic Networks Defined*

Mella (2009, p. 71) defines a *holonic network* as "a *network of horizontal relations*…with holons of the same level". He further states (Mella, 2009, p. 72):

> In the holonic network the holons are not arranged in a hierarchy with others and there are no vertical links, only relations among elements at the same level; we do not observe an *above* (containing) and a *below* (contained) but only—or also—a *before* (component, antecedent, constituent) and an *after* (composite, successive, constituted), in the typical relational observational variants of left/right, input/output, up the line/down the line, etc.
>
> As with the holarchy, in the *holonic network* each holon is also a whole, an entity, whose existence, or meaning, comes at the same time from the connected elements that are observed as *antecedents (before)* and are constituent elements of the holon and by those that are observed as *successive (after)*.
>
> Nevertheless, the holon *is not included* in those that follow it in the network and does not include those that precede it; it constitutes a *node* that composes (is inserted in) the holonic network and that possesses the functioning, function, functionality and spatial-temporal placement that justify it, and it acquires meaning from the network itself, that is by the antecedent holons and the successive ones.
>
> *An important point*: like holarchies, the *holonic networks* are not holons but *conceptual entities*—horizontal or grid systems—whose nodes are holons which are interconnected according to their nature as entities whose meaning comes from their important horizontal interactions, in order to form a whole: that is, the holonic network.

We can think of holonic networks as two kinds: *reticular holarchies* and *orgonic networks*. Reticular holarchies "take on the significance of *networks of networks*" (Mella, 2009, p. 74). Whereas orgonic networks are "composed of *org*anizations-hol*ons*" or a network of orgons (Mella, 2009, p. 74).

Figure 6 shows Mella's illustration of reticular holarchies and orgonic networks.

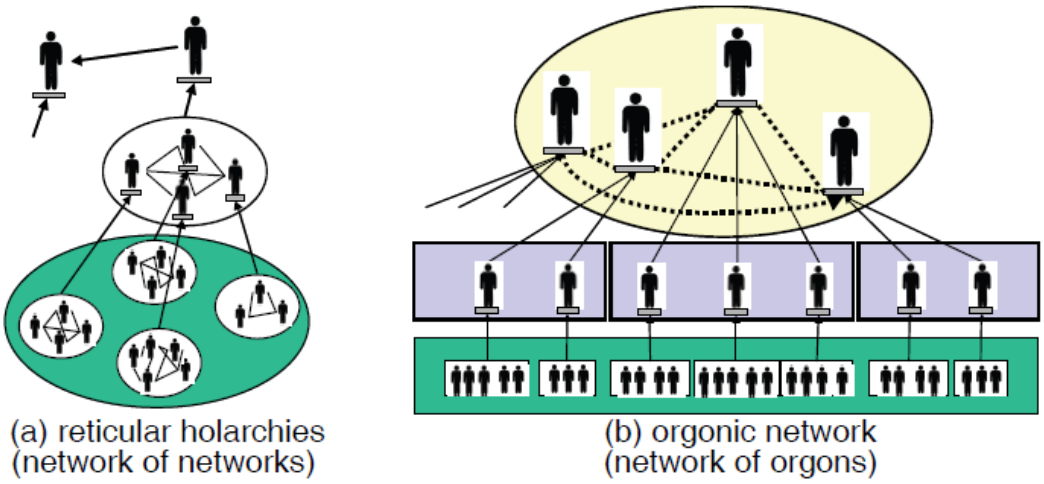

Fig. 6 – Mella's Models of Holarchies as a Multi-Layer Agent System (Mella, 2009, p. 75)

3 – Terms & Definitions for Holarchical Innovation Teams (HITs)

Before we can define HITs, it is important to identify and define pertinent antecedent terms.

3.1 – *Definition of Creative Work*

In order to understand holarchies within a HITs context, we first need to address the term *Creative Work*. The Creative Kaizen LinkedIn Group defines creative work as

> The application of synthetic and creative human imagination that actualizes the full potential of a human being who transforms, according to the laws of nature, given elements through arrangement and combination to produce utility in the world (Reber 2019a, slide 8).

Napoleon Hill (1937/2016) and Ludwig von Mises (1998) both help illuminate the word *Imagination*. Hill identifies two types of imagination: synthetic and creative. *Synthetic Imagination* is reflecting on and understanding of the past and present to arrange old concepts, ideas, or plans into new combinations (Hill, 1937/2016, p. 98). *Creative Imagination* is receiving hunches and inspirations as a basis for new ideas (Hill, 1937/2016, p. 98). Thus, our definition of Creative Work includes the two kinds of imagination.

In addition to Hill, Mises distinguishes between the words *production* and *imagination*:

> Action, if successful, attains the end sought. It produces the product. Production is not an act of creation; it does not bring about something that did not exist before. It is a transformation of given elements through arrangement and combination. The producer is not a creator. Man is creative only in thinking and in the realm of imagination. In the world of external phenomena he is only a transformer. All that he can accomplish is to combine the means available in such a way that according to the laws of nature the result aimed at is bound to emerge (von Mises, 1998, p. 140).

Furthermore, a phrase is required to identify the fact that a person must transform imagination into physical reality. Therefore, the definition adopts Mises' phrase "*according to the laws of nature, given elements through arrangement and combination to produce utility in the world*".

Finally, the phrase "*actualizes the full potential of a human being*" is included in order to reference that work is a self-actualizing activity of the individual where physical things are transformed into utility for others to enjoy.

3.2 – *Definition of Creative Kaizen*

The Japanese word *Kaizen* (改善) can be roughly translated as continuous improvement. The foundations of *Kaizen* are in Musashi Miyamoto's *The Book of Five* Rings (1644; recent edition, 2021). For our purposes, *Kaizen* refers to the English word "continuous" because one's mental and physical capacities operate continuously and one's self-actualization is continuous upon death. From the perspective of General System Theory (GST), all things in the universe move at a continuous rate (von Bertalanffy, 1968). Based on the aforementioned, the definition of Creative Kaizen is as follows and illustrated in Figure 7:

> The application of creative work within the framework of continuous improvement that empowers people to function in holarchical innovation teams moving from one innovation project to the next, up the Competency & Topic Altitude and across the Topic Spectrum of Innovation (Reber, 2019a, slide 9).

Briefly, "The Way of Work" Matrix illustrates HITs within an organizational context. The Wedgewood Company is an easy example to explain this. The vertical axis is the Competency & Topic Altitude, such as Novice Teacup Designer (1A) to Expert Teacup Designer (1E). The horizontal axis is the Topic Spectrum, such as Teacup Designer (Topic Group 1), Teacup Assembler (Topic Group 2), and Salesperson (Topic Group 3). In theory, one should be able to advance up and across the Matrix within the Wedgewood Company.

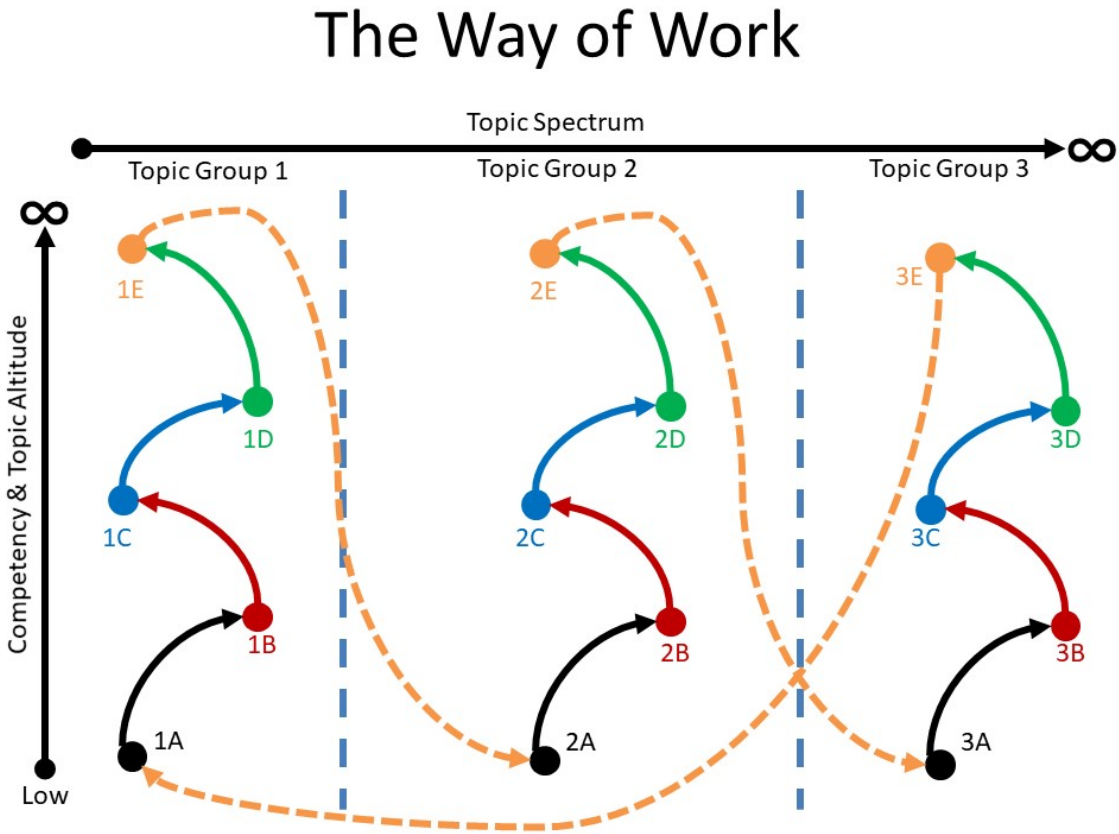

Fig. 7 – The Way of Work (Reber, 2019a, slide 10)

3.3 – *Definition of Holons*

In terms of HITs, we will define a Holon as:

> *An independent, self-regulating open system that displays both the autonomous properties of wholes and the dependent properties of parts without any connection to other systems; and also contains the elements of Mission and Purpose, Specifications, Functions, and Structures (Enabling Systems).*

A Holon can be illustrated as follows in Figure 8:

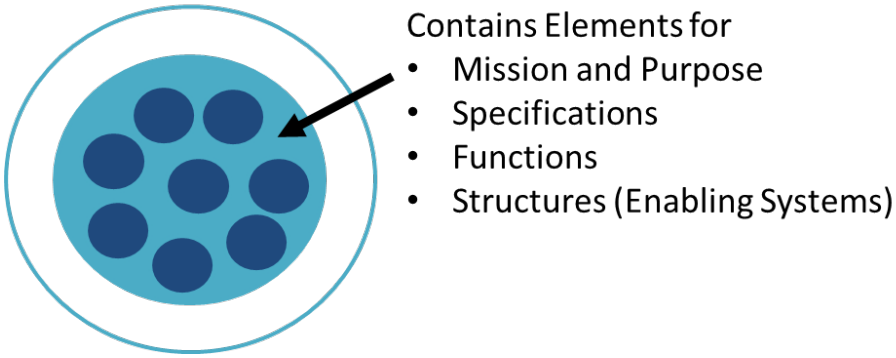

Fig. 8 – Holon (Reber, 2019b, p. 12)

The elements of a Holon are defined as (Reber, 2022a, slide 4):

- *Mission Statement*: A general statement about what a Holon does for the system.
- *Statement of Purpose*: A general statement about how the Holon implements the mission; that is, it addresses the design arrangements of the system.
- *Specifications*: A general statement about who or what the Holon serves in the system, what are the services, how the Holon provides the services, and what is the Holon's relationship to other Holons in meeting the mission.
- *Functions*: These are action statements (using action verbs), i.e. duties/responsibilities of the Holon.
- *Structures (Enabling Systems)*: These are the management and organizational components of the system to which the Holon belongs and with which it interacts to carry out its functions.

3.4 – *Holons Interaction*

When two or more holons interact with each other, a so-called *holonic connection* is established. Therefore, when two holons interact their *systems* exchange information and align each other's elements. These element alignments create synergies. This means

> the missions align to create a new holonic structure greater than the two holons individually; hence, new purpose, specifications, functions, and structures are created in the holarchical form (Reber, 2019b, p. 13).

For our purposes, we define holonic connection as follows:

When two or more holons interact with one another to create a holonic connection that allows the two holonic systems to exchange information and align with each other so as to create synergies and a new holonic structure greater than the two holons individually; thereby creating a new purpose, specifications, functions, and structures in the holarchical form.

Figure 9 illustrates two holons establishing a holonic connection.

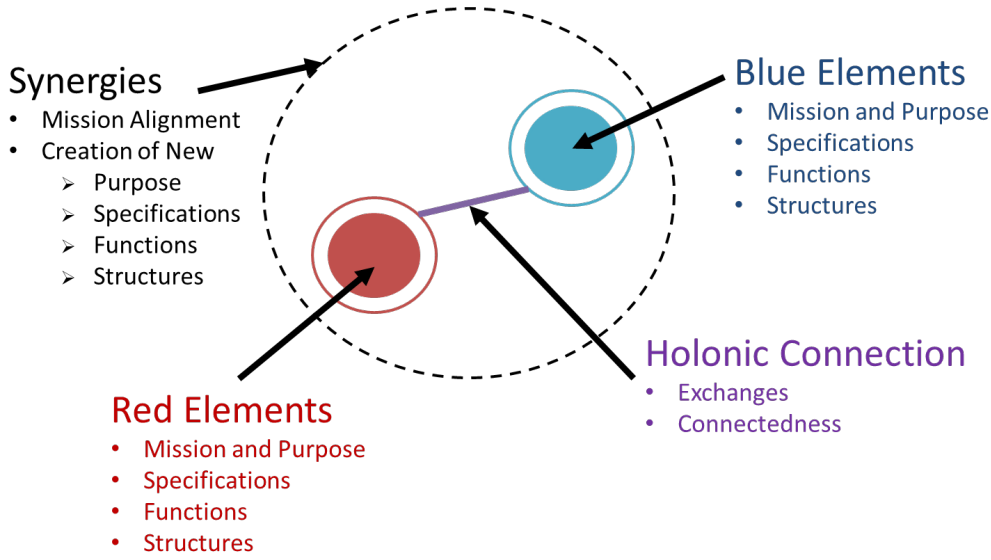

Fig. 9 – Holonic Connection (Reber, 2019b, p. 14)

3.5 – *Definition of Holarchy*

Based on the aforementioned definitions of Holarchy and our current understanding of holons, for HITs we define a Holarchy as:

Self-assembling holons that form in an obligate mutualistic symbiotic relationship to achieve a common stated mission and purpose, creating specifications, functions, and structures with holonic connections that obliterate the dichotomies of far/close, small scale/large scale, and inside/outside to achieve the mission and purpose of the new holonic structure.

To be clear, a *holarchy* is not the same as a *hierarchy*. According to Ervin Laszlo,

> [a Holarchy's success] is measured by [its] ability to anticipate changes in its sub- and super-structures and to cope with them.…[It] is not a passive system, committed to the status quo [but] a dynamic and adaptive entity, reflecting in its own functioning patterns of change over the levels of the system (Laszlo, 1996, pg. 58).

Furthermore, Laszlo states:

> Organization in nature comes to resemble a holarchic pyramid, with many relatively simple systems at the bottom and a few complex systems at the top. Between them all natural systems take intermediate positions; they link the levels below and above them. They are wholes in regard to their parts, and parts with respect to higher-level wholes. Individual systems within a complex system have the role of coordinating interfaces. They assume the liaison between those (lower-level) components of the system which they control, and those (higher-level) ones which exercise control over them. Their

> function is to pull together the behavior of their own parts, and to integrate this joint effort with the behavior of other components in the system. This is a function which all natural systems must perform if they are to maintain themselves (Laszlo, 1996, pg. 53).

Figure 10 illustrates a general view of a Holarchy of an organization.

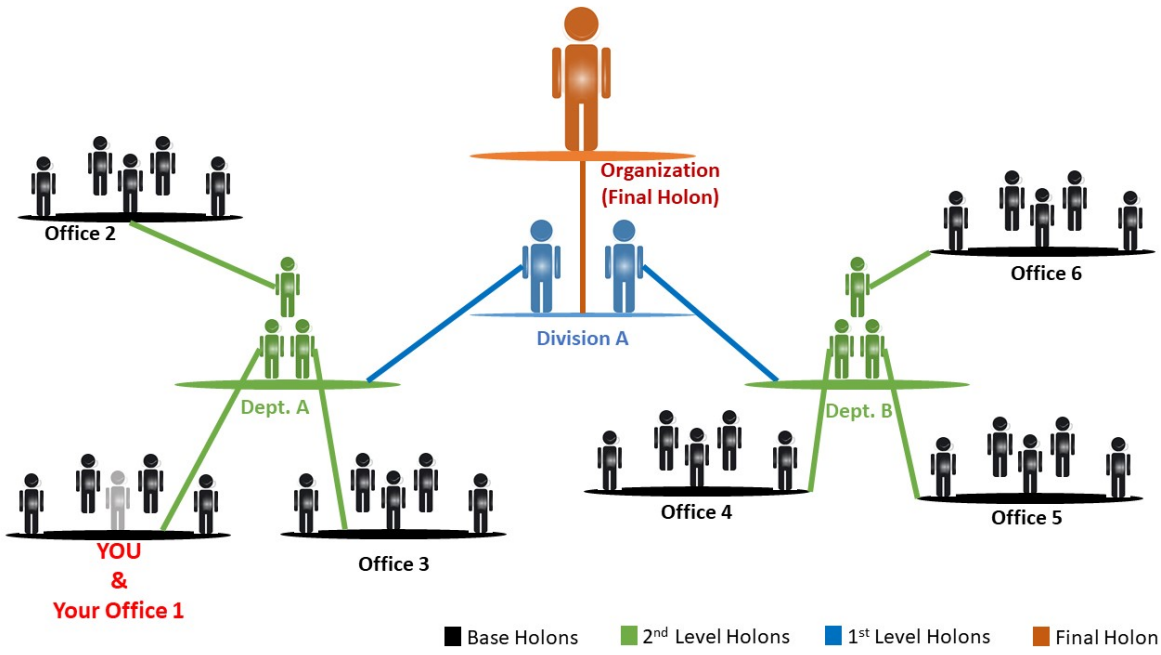

Fig. 10 – Holarchy of an Organization (Reber, 2022b, slide 5)

It can be observed that the organization is the Final Holon in the holarchy. An organizational holarchy is analogous to the human body where the human body is the Final Holon made of molecules, cells, tissues, and organs.

3.6 – *Definition of Innovation*

For the purposes of HITs, we adopt Kenneth P. Morse's formula for innovation (2013):

INNOVATION = INVENTION + COMMERCIALIZATION

The USPTO – US Patent & Trademark Office – Online Glossary defines "*Invention*" as:

> any art or process (way of doing or making things), machine, manufacture, design, or composition of matter, or any new and useful improvement thereof, or any variety of plant, which is or may be patentable under the patent laws of the United States.

In addition, the USPTO Online Glossary defines an "*Inventor*" as "*one who contributes to the conception of an invention*". However, the term "*Innovation*" is not in the USPTO Glossary.

Despite this guidance by the USPTO, we must not confuse the terms *Invention* and *Innovation*. Simply put, innovation is a commercialized invention or the monetization of an invention, i.e. value-creation.

True, in the colloquial sense, people interchange the words *innovation* and *invention* – When we say people are innovating even though they are not selling their invented practices in the

marketplace, what we really mean is that they are being *inventive*. It is only when one transmutes invention into monetized value (commercialization) can we call it *innovation*. The free market system is the venue in which commercialized value is determined. Frédéric Bastiat makes this explicit in his description of the free market:

> Commerce (free, of course, otherwise I could not reason upon it), commerce, I say, is led by its own interests to study the seasons, to give daily statements of the state of the crops, to receive information from every part of the globe, to foresee wants, to take precautions beforehand. It has vessels always ready, correspondents everywhere; and it is its immediate interest to buy at the lowest possible price, to economize in all the details of its operations, and to attain the greatest results by the smallest efforts (Bastiat, 2007, pg. 21).

Therefore, the *creative* in Creative *Kaizen* means to innovate, not invent. In terms of HITs, this also means applying the "7-STEP" Plan, Do, Check, Act (PDCA) Cycle as explained in *The Problem Solving Memory Jogger*:

STEP 1. Describe the problem

STEP 2. Explain the current processes or solutions to address the problem

STEP 3. Identify the root causes of the problem

STEP 4. Create an innovative solution with an action plan to implement the solution

STEP 5. Perform proto-type testing to implement the solution

STEP 6. Review and evaluate the test results

STEP 7. Reflect upon the evaluations in order to improve upon the solution

3.7 – *Definition of Team*

For HITs, we adopt the American Society for Quality Online Glossary definition of the term "Team" that means,

> A group of individuals organized to work together to accomplish a specific objective.

As mentioned previously, Creative *Kaizen* means to *innovate*. Therefore, the purpose of a HIT is for individuals to come together and work in a *team* to create value for society. Figure 7 "The Way of Work" Matrix illustrates how HITs form and move across an organization's matrix. This is similar to Miyamoto's description of the carpenter (n.d., p. 6):

> The foreman carpenter allots his men work according to their ability…. The foreman should take into account the abilities and limitations of his men, circulating among them and asking nothing unreasonable. He should know their morale and spirit, and encourage them when necessary.

In theory, each person in a HIT is assigned a commensurate job role according to ability and interest. Furthermore, each person receives encouragement, coaching, and direction from those responsible for ensuring success in creating value.

3.8 – *Definition of Combinatory Systems Theory*

We adopt Mella's Combinatory Systems Theory (CST), which holds that a combinatory system is:

> any collectivity…whose agents, consciously or unconsciously, act (exclusively or prevalently) on the basis of global information…which they directly produce and update as the consequence of their micro behavior and the micro-macro feedback (Mella, 2017, p. 46).

This is rather important for HITs in that it makes clear that each individual team member is acting upon "global information" that the team creates which in turn creates a virtuous cycle in order for the organization to create value for society, specifically, high quality, low cost, and innovative products. It could therefore be assumed that in a HIT an effect typical of the logic of Combinatory Systems develops, also through the coordination and synchronization effect derived from the micro-macro feedback mechanism. In a broader sense, a HIT could be understood as a combinatorial system of order and improvement.

3.9 – *Definition of Holarchical Innovation Team*

Now that we have identified and defined pertinent antecedent terms, we can define what we mean by HITs. For his *HITs Concept Development Matrix*, Reber (2020) defines HITs as:

> *Self-assembling teams working together in an obligate mutualistic symbiotic relationship, according to the principles of combinatory systems theory, moving from one innovation project to the next, up the Competency & Topic Altitude and across the Topic Spectrum of Innovation to produce high quality, low cost, and innovative products.*

It is important to elaborate on what we mean by *self-assembling*. In terms of HITs, self-assembling implies spontaneous. Therefore, self-assembling teams are in fact spontaneous systems. Mella states (Mella, 2017, p. 54):

> *Spontaneous systems* can be defined as "*natural*" (in the relative and conventional meaning of the term), producing ordered micro behavior that can be viewed as forms of *self-organization*. In other cases we can observe *ad hoc* rules to form combinatory systems, and as such we can define these as "*artificial*".

A HIT may start out as independent agents or systems acting in accordance with CST, but at a certain point those independent agents or systems align in an *obligate mutualistic symbiotic relationship*. For example, let us consider the newly developing phenomenon of Open Government Data (OGD) as illustrated in Figure 11.

In the beginning, the government collects, organizes, and disseminates its data without any systematic organization between government agencies, the public, and private enterprise. Then, government agencies start to recognize the interconnections between their data and then integrate their data sharing systems. Next, as the government makes data available to the public, the government receives requests to provide better data. This causes government agencies to communicate about their data and create countermeasures to meet the public demand. Sometime thereafter, a supra-structure OGD Holarchy exists with micro-macro feedback loops to improve the acquisition, review, categorization, assimilation, quality, and dissemination of data.

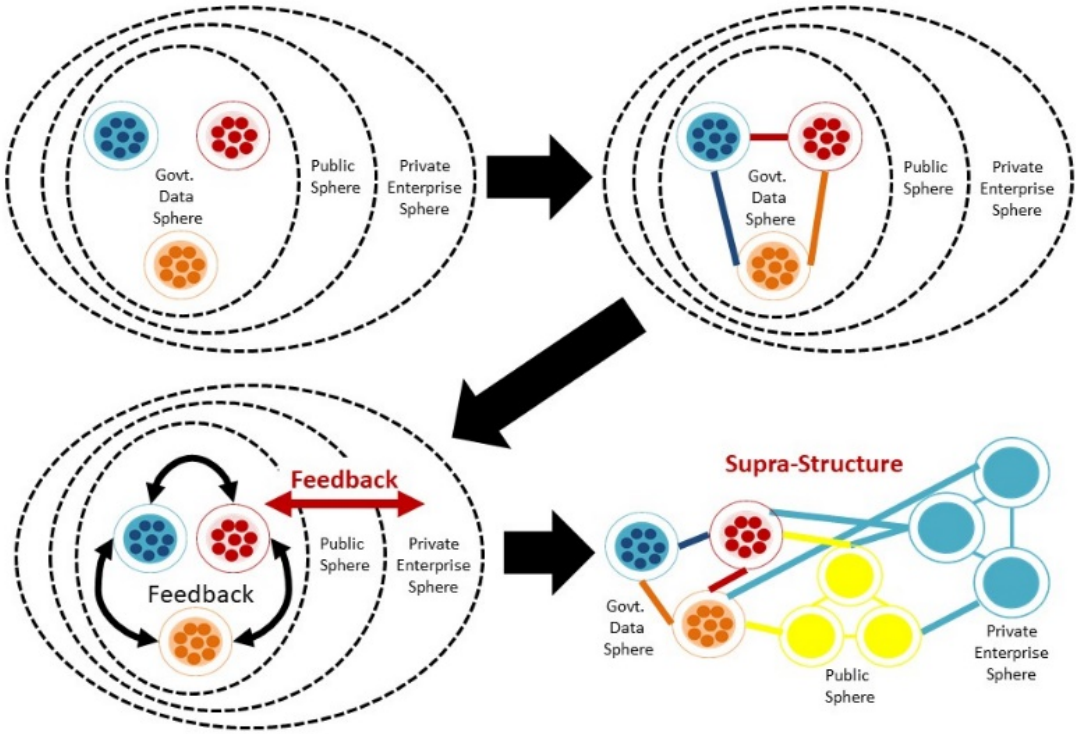

Fig. 11 – HITs in an Open Government Data Holarchy

To summarize, the above figure helps illustrate the link between the holonic conception and that of HITs. As stated previously, HITs are considered *self-actualizing* organizational systems. This means individuals perform work commensurate with skill, interest, and personality, moving up the Competency & Topic Altitude and across the Topic Spectrum of an organization. In the realm of OGD, individuals create data, collect data, categorize data, assimilate data, and disseminate data. They do this not because it is just another "job" to earn a living, but because it is human activity that they enjoy doing for themselves and for others as value-creation activity. Finally, HITs dissolve the organizational dichotomies of Far/Close, Small Scale/Large Scale, and Inside/Outside. As shown in the supra-structure system above, the Government Data Sphere, the Public Sphere, and the Private Enterprise Sphere are bound by holonic connections. These spheres exchange information and align with each other to create synergies, resulting in the creation of the OGD holonic structure that is greater than each sphere individually. Furthermore, the effect typical of the logic of Combinatory Systems develops because actors within the holarchy *act* upon the "global information" of OGD. Even though it may appear to the casual observer that data created by actors at one end of the holarchy are irrelevant to actors at the other end of the holarchy, the data may in fact be very relevant regardless of distance, size, and affiliation of the actors. It is this combination of self-actualization and the dissolution of organizational dichotomies that makes HITs truly "holarchical innovation teams" creating value in a fast-paced, interconnected world.

4 – Conclusion

Having argued for *holarchical thinking*, reviewing the antecedents of Holarchical Innovation Teams (HITs), and *attempting* to establish a HITs etymology, it can be recognized that a greater

discussion is required in developing the nascent discipline of HITs. Furthermore, subsequent papers are required to address both philosophy and principles of HITs that help build the case for widespread holarchical thinking.

As stated previously, today we live in an *interconnected* "combinatory" world with *interconnected* problems that require *interconnected* solutions. In other words, we live in a HOLARCHICAL WORLD, a world of freedom, creativity, and humanity that necessitates holarchical thinking. The commitment of future work programs such as the creation of organizational systems that foster HITs, the development and application of HITs methods, and the qualitative and quantitative study of HITs praxis will be necessary.

Therefore, it is the purpose of this paper and successive papers to establish the human interaction foundations for holarchical society by starting with a simple etymology of holarchical innovation teams.

5 – References

American Society for Quality. (n.d.). Team. In *American society for quality online glossary*. https://asq.org/quality-resources/quality-glossary/t

Bastiat, C.F. (2007). *The bastiat collection* (2nd ed.). Ludwig von Mises Institute. https://cdn.mises.org/The%20Bastiat%20Collection_4.pdf

Berger, P. (2022, August 26). Warehouse bottlenecks are snarling U.S. supply chains. *The Wall Street Journal*. https://www.wsj.com/articles/warehouse-bottlenecks-are-snarling-u-s-supply-chains-11661529092?st=5bdppyf71vddzf4&reflink=desktopwebshare_permalink

Brueckner, S.A., Serugendo, G. Karageorgos, A., Nagpal, R. (Eds.). (2005). *Engineering self-organising systems: Methodologies and applications*. Springer. https://www.google.co.jp/books/edition/Engineering_Self_Organising_Systems/guYACAAAQBAJ?hl=en&gbpv=0

Capra, F. (1982). *The turning point: Science, society, and the rising culture* (Bantam ed., 1988). Simon & Schuster. https://archive.org/details/turningpointscie0000capr/page/n5/mode/2up?view=theater

Collister, R.C. *A journey in search of wholeness and meaning*. Peter Lang AG, Internationaler Verlag der Wissenschaften. https://www.google.co.jp/books/edition/A_Journey_in_Search_of_Wholeness_and_Mea/OIteMHsu4J8C?hl=en&gbpv=0

Edwards, M. (n.d.). *A brief history of holons*. Integral World. https://www.integralworld.net/edwards13.html

Edwards, M. (2009). *Organisational transformation for sustainability (routledge studies in business ethics)*. Routledge. https://books.google.co.jp/books/about/Organizational_Transformation_for_Sustai.html?id=pdiOAgAAQBAJ&redir_esc=y

GOAL/QPC. (2011). *The problem solving memory jogger* (2nd ed.).

Hill, N. (2016). *Think and grow rich*. Skyhorse Publishing. (Original work published in 1937). https://archive.org/details/thinkgrowrich0000hill_y8b5/page/n1/mode/2up?view=theater

Koestler, A. (1989). *The ghost in the machine*. Arkana Books. (Original work published in 1967). https://archive.org/details/ghostinmachine00koes/page/n3/mode/2up?view=theater

Kuhn, T. (2012). *The structure of scientific revolutions* (4th ed.). The University of Chicago Press. (Original work published in 1962).

https://archive.org/details/structureofscien0000kuhn/page/n5/mode/2up?view=theater

Laszlo, E. (1996). *The systems view of the world: A holistic vision for our time*. Hampton Press.

Leonard, G. (2000). Ken Wilber's Twenty Tenets. http://www.esalenctr.org/display/confpage.cfm?confid=10&pageid=113&pgtype=1.

Mella, P. (2009). *The holonic revolution: Holons, holarchies and holonic networks: The Ghost in the production machine*. Pavia University Press. http://dx.doi.org/10.13140/2.1.1954.5922

Mella, P. (2017). *The combinatory systems theory*: *Understanding, modeling and simulating collective phenomena*. Springer Cham. https://doi.org/10.1007/978-3-319-54805-0

Mella, P. & Gazzola, P. (2017). The holonic view of organizations and firms. *Systems Research and Behavioral Science*. https://onlinelibrary.wiley.com/doi/abs/10.1002/sres.2457

Miyamoto, M. *The book of five rings*. Original work published 1644. An English translation provided by http://www.holybooks.com is here. https://www.holybooks.com/wp-content/uploads/The-Book-of-Five-Rings-by-Musashi-Miyamoto.pdf

Morse, K. (2013, March 5). *Innovate or die* [Video]. YouTube. https://www.youtube.com/watch?v=VIfoNb3ZQ1E

Muscato, C. (n.d.). *Sumerian social structure* [Video]. Study.com. https://study.com/learn/lesson/sumerian-social-structure-facts.html#:~:text=Sumerian%20civilization%20featured%20a%20social,class%2C%20which%20mainly%20comprised%20farmers

Reber, M.F. (2019a). *Creative Kaizen LinkedIn group public service announcement* y*PowerPoint "A new way of work is arriving"* [PowerPoint slides]. LinkedIn Michael F. Reber Profile. https://www.linkedin.com/posts/michael-f-reber_creative-kaizen-public-service-announcement-activity-6968731908130140161-8P37?utm_source=share&utm_medium=member_desktop

Reber, M.F. (2019b, November 13). *Creative Kaizen: Innovative continuous improvement (CI) for 21st century work: LinkedIn community feedback draft*. https://www.linkedin.com/posts/michael-f-reber_creative-kaizen-for-21st-century-work-activity-6600219001215905792-gmoU?utm_source=share&utm_medium=member_desktop

Reber, M.F. (2019c, November 18). *The celandine way: LinkedIn community feedback draft*. https://www.linkedin.com/posts/michael-f-reber_the-celandine-way-activity-6602065333291446273-S67Y?utm_source=share&utm_medium=member_desktop

Reber, M.F. (2020, February 15). *HITs concept development matrix*.

Reber, M.F. (2022a). *Holarchies for beginners: Value stream mapping with holons, holarchies, and holonic networks: Module 1 course* [PowerPoint slides].

Reber, M.F. (2022b). *Holarchies II: Future state value stream mapping with holons, holarchies, and holonic networks: Module course* [PowerPoint slides].

Robertson, B.J. (2015). *Holacracy: The new management system for a rapidly changing world*. Henry Holt and Company. https://archive.org/details/holacracynewmana0000robe/page/n9/mode/2up?view=theater

Rudd, O. (2009). *Business intelligence success factors: Tools for aligning your business in the global economy*. John Wiley & Sons, Inc. https://www.google.co.jp/books/edition/Business_Intelligence_Success_Factors/T_NFf2uhnWgC?hl=en&gbpv=0

Serugendo, G., Gleizes, M., Karageorgos, A. (Eds.). (2013). *Self-organising software: From natural to artificial adaptation (natural computing series)*. Springer.

https://www.google.co.jp/books/edition/Self_organising_Software/uC5r_laaVa4C?hl=en&gbpv=1&printsec=frontcover

Serguendo, G., Karageorgos, A., Rana, O., Zambonelli, F. (Eds.). (2004). *Engineering self-organising systems: Nature-inspired approaches to software engineering*. Springer. https://www.google.co.jp/books/edition/Engineering_Self_Organising_Systems/fswhwonHbvsC?hl=en&gbpv=0

Should we worry about artificial intelligence? (2022, July 19). *The Wall Street Journal*. https://www.wsj.com/articles/should-we-worry-about-artificial-intelligence-smart-technology-sentience-human-future-11658261607?st=225w7twn9e0jybn&reflink=desktopwebshare_permalink

Smith, A. P. (2002). *Wilber's Eight-Fold Way How Many Sides Does a Holon Have?*, at: http://207.44.196.94/~wilber/smith18x.html.

Tita, B. (2022, May 29). Robots pick up more work at busy factories. *The Wall Street Journal*. https://www.wsj.com/articles/robots-pick-up-more-work-at-busy-factories-11653822002?st=if0pqaufmedpcol&reflink=desktopwebshare_permalink

United States Patent & Trademark Office. (n.d.). Invention. In *United states patent & trademark office online glossary*. https://www.uspto.gov/learning-and-resources/glossary#sec-I

United States Patent & Trademark Office. (n.d.). Inventor. In *United states patent & trademark office online glossary*. https://www.uspto.gov/learning-and-resources/glossary#sec-I

von Bertalanffy, L. (1968). *General system theory: Foundations, development, applications*. George Braziller. https://archive.org/details/generalsystemthe0000bert_f7s2/page/n5/mode/2up?view=theater

von Mises, L. (1998). *Human action*. von Mises Institute. https://mises.org/library/human-action-0

Wilber, K. (1995). *Sex, ecology, spirituality: The spirit of evolution*. Shambhala Publications. https://archive.org/details/sexecologyspirit00wilb/page/n11/mode/2up?view=theater