Opportunity-as-Hologram, real or artificial in Entrepreneurship

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Entrepreneurship concerns actions under uncertainties. Situated within that uncertainties are opportunities that entrepreneurs seek. How are these opportunities seen? Within the entrepreneurial opportunities are seeds with potentialities. Potentialities for profits. They are the reasons that entrepreneurs act up to exploit and to set in motion the entrepreneurial emergence. The intentionality follows with construction of a coherent set of activities or incoherent intuitive moves to pursue the opportunity, including injecting resources and mobilizing social and material networks. How are opportunities discovered, and perceived? The current academic debates feature discovery and creation. Are they existing independently, with pre-existing reality, even without being observed? Or as some argued that opportunities are not pre-existing in space and time with an objective existence but are subjectively and socially constructed. On contact with such opportunities, what spur entrepreneurs to act and what are the forces at work? Are they real or artificial? Can they be holographic representation and provide cues and signals to entrepreneurs to act? Can opportunity-as-hologram explains how entrepreneurs get inspired and motivated to pursuing the opportunities?

This paper will explore, revisit and recast perspectives on opportunities and addressing the subtle conceptual issues at the core of entrepreneurship theories that hold the two views, discovery and creation of opportunities to be both valid and mutually non-exclusive, on holographic terms. In the discussion, this paper will explore implicate order and explicate order which are quantum theory concepts theorized by physicist David Bohm as these theories were developed to explain the bizarre and unpredictable behaviours of subatomic particles, which have strong semblance to the same free-spiritedness and free-will self-organization behaviours of entrepreneurs.

Our theorization will have implications for entrepreneurs and entrepreneurial researches relating to quantum science references.

INTRODUCTION- FRAMING CONNUNDRAM ON THE NOTION OF OPPORTUNITIES

To date, the phenomenological study of entrepreneurship lacks a unifying conceptual framework. To reframe the notion of opportunities as described by (Venkataraman et al., 2012) with quantum science terms that can explain and predict a set of empirical phenomenological events and process is the main core of this paper. Entrepreneurship is about opportunities (Shane & Venkataraman, 2000).

To reframe the two views of opportunities discovery and creation and to clarify the position that the subjectivities of the creation process and the objective existence of opportunities are not contradictory; this paper will explore conceptually

how these opportunities are viewed and thereafter responded to by alert entrepreneurs using all their resources at their disposal to co-create the future. Both these views are established only on the basis of agency-intensive and dependence meaning that the entrepreneurs are central as the main casts who must first see the opportunity or to create the opportunity and their actions thereof set in motion a series of entrepreneurial activities that is the subject of this paper. Lastly, we are also exploring the forces at work in interaction at the boundary or at the nexus (Shane, 2003)– at the cognitive contact between the entrepreneur with the opportunity. Opportunities-as-artifacts as a concept describes the interactivity between the entrepreneurs and their environments, where instantiations and exploitations are the drivers of the entrepreneurial process (Berglund et al., 2020). We are using quantum terms to describe opportunity-as-hologram as an alternative concept which can bring together the two views – discovery and creation as non-conflicting and can be mutually agreeable.

Entrepreneurial opportunities are typically situated in a space-time under varying degree of risks or uncertainty. The prevailing literatures feature discovery and exploitation, creation and co-creation of opportunities as if they are mutually exclusive that exist independent of entrepreneurs because the state of market is in disequilibrium (Chiles et al., 2007).

OPPORTUNITIES, ONTOLOGICALLY AND EPISTEMOLOGICALLY DEFINED

The core question in entrepreneurship relating to opportunities need further clarification. Are opportunities objective, independently existing that entrepreneurs discover, or are they subjectively derived and formed endogenously as the emergent pathway unfolds (McBride et al., 2013)? Meaning, entrepreneurs are the co-creator of the opportunities operating in an evolving environment. To properly understand the underlying nature of opportunity, the definitions must go to the roots and origins of how these opportunities are built on and where they are situated ontologically and epistemologically. Whether the entrepreneurial opportunity is ontologically subjective or objective, whether it is epistemological subjective or objective depends on angles of perception. Entrepreneurial opportunity is not a static object existing in space-time artefact (in the case of opportunity, where it is situated along the epistemological continuum between the subjective and objective but as the initial starting condition of a process vector that is situated somewhere on that continuum but always shift across it, to a greater or lesser degree, into increasing epistemological objectivity (McBride et al., 2013). Hence, epistemologically, opportunity can be viewed as the ongoing, continuously creative process of emergence with new realities unfolding as the entrepreneurs seek to co-create and to thrive.

The complexities of the entrepreneurship and entrepreneurial process are observable from a variety of paradigms and philosophical lens depending on the exploration perspective. Diagram 1, adopted from (Johnson & Duberley, 2000), illustrates the codification of entrepreneurship under various observations under different paradigms. Entrepreneurship has been defined as the nexus between the entrepreneur and opportunities (Sarason et al., 2006). This nexus is where the entrepreneur and the opportunity-as-artefact (Berglund et al., 2020) meet.

Entrepreneurship expressed in a multi-paradigm matrix, as seen below:

Adapted from Johnson, P., & Duberley, J. (2000). Introduction - the Importance of Epistemology in Management Research. *Understanding Management Research*. doi:10.4135/9780857020185.n1

Diagram 1, Opportunities situated on Ontological/ Epistemological matrix

What exactly is the promise of entrepreneurship (Venkataraman et al., 2012) or the promise of the opportunities? The promise of entrepreneurship lies in the *nexus* of the entrepreneur and opportunities (Shane & Venkataraman, 2000). Exploration on opportunities need solid dredging into the foundational layers to understand the real nature of opportunities and how they could be observed (Alvarez & Barney, 2007); (Ramoglou, 2013); (Randerson et al., 2016).

Opportunity discovery is premised on the notion that relevant aspects of the external environment exist independently of entrepreneur's perceptions and subsequent actions (Randerson et al., 2016). The environment therefore provides the external enablers (Davidsson, 2015), resource bundles (Lichtenstein & Brush, 2001) that determine the viability and sustainability of the entrepreneurial venture. The environmental realness, its objective ontological pivot, to empirically observable entities like opportunities that are pursued with socially constructed means, pivoting on subjective epistemology, (Alvarez & Barney, 2010) is situated in the quadrant of critical realism/ pragmatism. The realities including the social realities, exist independent of entrepreneurs' perceptions. "Opportunity discovery" pivots on the critical realist perspective as described in Quadrant 3. The task of entrepreneurs exploiting the discovery opportunities is thus to be "alert" (Miao & Liu, 2010) to the presence of these opportunities, real or artificial, and monetize/ profit from them through the set of entrepreneurial activities that will follow in the exploitation process.

Opportunity from the creation perspective (Alvarez & Barney, 2007) is premised on the notion that relevant aspects of the social realities exist primarily as social constructions that are sustained and altered through ongoing and concurrent entrepreneurial actions and interactions (Alvarez et al., 2016). Since they are historically and contingently evolved (Berglund et al., 2020), they can be seen as riddled with tensions and contradiction since this track of development is pivoting on subjective ontology and subjective epistemology in Quadrant 4. Hence, uncertainty in both subjectivities in the ontological/ epistemological pivot, is not overcome by gathering more information on a pre-existing external environment, but by being an active 2020participant in a process of gradually transforming it (Alvarez et al., 2015). It should be noted that the processual part of evolving changes need the entrepreneurs to be in a constant state of sensemaking. In this constructivist quadrant in Quadrant 4, it involves understanding how the entrepreneurs make sense of the external inputs at various hierarchical levels of interacting forces- environmental resources, competitive reactions, shareholders, sources of funds, etc- and enact this sense back into the decision-making process to make it more orderly, with sensemaking (Weick & Karl E, 1995). Sensemaking is a critical component as it deciphers understandable patterns and structure them through stereotyping by circling out identifiable groups/ clusters/ pigeon-holing. Therefore it is a form of noticing and bracketing, both retrospectively and prospectively (Weick et al., 2005). In short, seeing orderliness amidst chaos. Within the framework of opportunity creation, the other concepts that arise from it are effectuation and bricolage. Further exploration and examination of the root of effectuation and bricolage will be discussed below.

The processes of effectuation (Sarasvathy, 2001) and bricolage (Baker & Nelson, 2018) focus on entrepreneurial actions, thereby producing behavioural models each with their own conceptual developmental arc (Welter et al., 2016). As behavioural concepts, these two processes -effectuation and bricolage are opportunity creation sub-sets and refining and sharpening them theoretically can provide better narratives for a paradigmatic base from which further entrepreneurial study on motives and intentionality can be stacked upon.

To understand this framework in a clearer way, a triadic relationship (agent centricity-environment context-opportunity) will be used to shape the distinctions highlighting their overlaps and divergences that form tractable perspectives on the formation of these opportunities under the creation track.

	Opportunity	Context	Agent-centricity
Creation	Market imperfection and in state of disequilibrium. Opportunities cannot exist apart from the actions that form them and the agent-social reality/ environmental context in which they are embedded. They are necessarily agent-environment interactions and agent's action for their generative emergence.	Objective state of Knightian uncertainty where neither outcomes nor their probabilities can be estimated ex-ante.	Interacts and co-creating with environment to form a market imperfection and imbalance thus causing disequilibrium. Premising on entrepreneur-as-generator of market imperfection/disequilibrium.

Effectuation	<p>Unspecified possible (near term) future. A core claim of effectuation is that the agent can create a variety of effects when they attempt to exert influence over the things they can control i.e. their current means and the focus on selecting between possible effects that can be created with that set of means. The mean end point is indeterminate but focus on what can be done given the current set of resource bundles and capacity and to move towards an indeterminate near term future end point. Exploiting contingencies rather than prior experience through pre-existing information/ knowledge</p> <p>Opportunities are endogenous to and artefacts of the effectual process.</p>	<p>Bounded rationality stemming from incomplete and limitation of information/ perceptions of uncertainty and build on mean-based actions</p> <p>The future state arising from uncertainty does not arise exogenously but is from the enactment by the effectuating entrepreneur. Thus it is assumed that uncertain future can be sculpted and shaped through corresponding actions through effectuation.</p>	<p>Employs mean-based heuristics to tap the availability of resources in the environment; where potentiality is recognized from a market imperfection and imbalance. In short, capitalizing and exploiting from state of disequilibrium.</p>
Bricolage	<p>Unspecified (known or unknown problem). A process of making do with whatever available local socio-material resources by applying combinations of locally available resources to new problems and opportunities</p>	<p>Perception of resource scarcity and making do with what is on hand. Combining resources or recombinant to unpack-repack/ unlock-relock new source of value. Availability of resources in the environmental context provides reason for bricolage.</p> <p>Resource limitations can be seen both as problem and opportunity.</p> <p>Value-creating bricoleurs operate in resource-scarce and constrained environment characterized by limitations in socio-material networks.</p>	<p>Use locally available resources to resolve existing problems in a novel way or to create a new unconventional means to achieve an end through entrepreneurial improvisation. Bricoleurs draw from unrelated, underdeveloped or scarce resources during opportunity-formation process hence the actions represent a form of novel value creation.</p>

Table 1, assumptions about the nature of opportunity, context and actor in creation, effectuation and bricolage. Adapted from Welter, C., Mauer, R., & Wuebker, R. J. (2016). Bridging behavioral models and theoretical concepts: effectuation and bricolage in the opportunity creation framework. *Strategic Entrepreneurship Journal*, 10(1), 5-20.

Opportunity recognition, whether through discovery or creation, it is argued that opportunity formation in the environment harness the surrounding resources. The opportunity is relationally and communally constituted within the environment where the entrepreneur is situated (Fletcher, 2006). There is also another part in the equation that is crucial which is time. Time is a defining dimension in entrepreneurship but receives lesser exploration in theories of entrepreneurship. Timing is everything in entrepreneurial venturing with dimensions of emergence (i.e., timing of setting the initial conditions), pace (i.e., rhythm of movement and motion) and chronology (i.e., time-captured series of actions/ activities) (Bakker, 2018).

OPPORTUNITY SPACE

Time, space in entrepreneurship is highly relevant and identifying opportunities is essential to successful entrepreneurial activity (Fiet, 2019). Timing of action becomes more salient than any time and place of enactment is more important than any space. All theoretical perspectives are constrained by boundary conditions including an informational perspective. A central limitation of all theories related to the search and discovery/ creation of opportunities is that their effectiveness is constrained by the timing and place of an opportunity (Fiet, 2019). Entrepreneurial venture is not an event, specifically but a process interspersed with many events and spatial-temporal concepts have to be embedded in the processual entrepreneurial framework to understand how entrepreneurs function under time and space in the processual journey. When to act, where to act are important questions that determine entrepreneurial pathway development. Entrepreneurial venturing need to operationalize time and space contexts in relations to entrepreneurial opportunities, enactments and from the perspective of change in the entrepreneurial process.

The possibility space in which the entrepreneurs operate provides the social and material networks, resources bundles (Lichtenstein & Brush, 2001) and conditions for ventures but the entrepreneurs still must maintain a certain sharpness and entrepreneurial alertness (Ardichvili et al., 2003) (Karabulut, 2016) of the opportunities. In this respect, all the debates on opportunities whether they exist independently, real and objective pending discovery/ waiting for discovery or they are created through enactments by the entrepreneurs (Alvarez & Barney, 2007), the crucial part is what is next after identifying the opportunity. Or to put simply, discovery or creation, what triggers entrepreneurial actions. What drives the action? How is it driven? The antecedent variables of discovery or creation, whether real or artificial as described by (Sarasvathy, 2003), in the minds of the entrepreneurs, they perceive the energy gradients in those opportunities and look towards the dissipation of the gradient to capitalize and monetize on that opportunity (Lichtenstein, 2007). It is this perception of the gradient, signalling and calling to actions that are what finally matter in entrepreneurial actions. The dissipative mechanism will be the set of entrepreneurial activities put together by the entrepreneurs to reach the outcome, through the play of the gradient, by exploitation (Adner & Levinthal, 2008).

An interesting natural phenomenon is the stored energy in gradients “through molecular recognition” of energy stored in gradient (DeLanda, 2011) Such phenomenon can also be applied to opportunity recognition based on entrepreneurial alertness to opportunities. Entrepreneurial alertness is a necessary condition for the identification triad- recognition, development, and evaluation (Ardichvili et al., 2003). In addition to alertness, entrepreneurs need the cognitive and affective temperaments to detect and identify the opportunity to appraise the feasibility and potential, hence in this case assess the energy-gradient for value within the discovered opportunity (Sadler-Smith, 2016). Finally for opportunity exploitation (Shane & Venkataraman, 2000) entrepreneurs must possess the passion, motivations, cognitive skills and abilities and resources to be able to engage in the exploitation and capitalization of viable new discoveries.

In summary, is a realist or a constructivist perspective in opportunity what matters? The entrepreneurial opportunity, whether ontologically subjective or objective, whether epistemological subjective or objective are not as critical as what eventually drive the actions. As explained in earlier section, entrepreneurial opportunity is not a static artefact or a still-frame waiting to be discovered. Whether real or artificial the opportunity is but a signal that calls out for entrepreneurial action.

ON QUANTUM LEVEL, WHOLENESS AND IMPLICATE ORDER CONCEPTS

Bohm's ground-breaking implicate order theory (Bohm, 2002) was to add to further contemplation on classical Newtonian-Cartesian concepts and those of relativistic mechanics (Bohm, 1971) (Bohm, 1973). The implicate and explicate order, expounded by Bohm, take the view of a processual approaches through dynamic and coherent enfoldment and unfoldment iterative actions. Bohm's worldview described in (Bohm, 2002) is fundamentally about movement, where past events (in this case of entrepreneurial exploration, past events, experiences, prior actions) are enfolded and then explicated in a continuous flux-flow into the future.

‘Not only is everything changing, but all is flux. That is to say, what is the process of becoming itself, while all objects, events, entities, conditions, structures, etc., are forms that can be abstracted from this process.’
(Bohm, 1980 p. 61)

The complementarity is reflected through Bohm's perpetual unfolding and enfolding process leading to wholeness of ‘explicate’ and ‘implicate’ orders. Implicate order/ explicate order are ontological concepts and are used to describe two different aspects of movement from the same phenomenon or aspect of reality. In particular, the concepts were developed in order to explain the bizarre and unpredictable behaviour of subatomic particles which quantum physics struggles to

explain. At this level, it is similar to the free-will enactment and actions taken by entrepreneurs. Elementary particles have highly complicated internal structure; essentially acting as amplifiers of information contained in a quantum wave (Storoy, 2014). The allusion that entrepreneurs exhibit the same kind of behaviours - responding to different degrees of risks and uncertainties. Hence, in here, we argue that Bohm's implicate order provides an attractive conceptual framework for such an understanding which shall be further elaborated in the discussion section.

Process as flux

Bohm's work in physics has predominantly been focused on the problem of motion and process which relativity physics deals with but quantum theory does not. Bohm proposes the notion of quantum potential, a mean by which the view of universal, unbroken wholeness, implicit in relativity theory must be understood in the context of the more abstract, fragmentary approach of much of quantum mechanics. His theory of the implicate order, an approach whereby implicit potentials can be seen to unfold out of a universal, unbroken field into explicit phenomena before being re-enfolded, has provided a new and valuable interpretation of quantum mechanics (Bohm, 2006).

In the undivided wholeness, Bohm's universal flux are dynamically and implicitly interconnected through what he called active information. The view that the universal flux, events and processes being integrally connected is necessary (Bohm, 1980). The flux, events and process references are good to use to shape the entrepreneurial framework from flux arising out of entrepreneurial process punctuated with entrepreneurial events. This will be discussed in the section below. Thus, instead of envisaging entrepreneurship as an event it should be envisaged as a "world-tube". As described in (Bohm, 1980), the world-tube represents an infinitely complex process of a structure in movement and development which is centred in a region indicated by the boundary of the tube.

'The new form of insight can perhaps best be called Undivided Wholeness in Flowing Movement. This view implies that flow is, in some sense, prior to that of the 'things' that can be seen to form and dissolve in this flow. One can perhaps illustrate what is meant here by considering the 'stream of consciousness'. This flux of awareness is not precisely definable, and yet it is evidently prior to the definable forms of thoughts and ideas which can be seen to form and dissolve in the flux, like ripples, waves and vortices in a flowing stream. As happens with such patterns of movement in a stream some thoughts recur and persist in a more or less stable way, while others are evanescent. The proposal for a new general form of insight is that all matter is of this nature: That is, there is a universal flux that cannot be defined explicitly but which can be known only implicitly, as indicated by the explicitly definable forms and shapes, some stable and some unstable, that can be abstracted from the universal flux. In this flow, mind and matter are not separate substances. Rather, they are different aspects of one whole and unbroken movement. In this way, we are able to look on all aspects of existence as not divided from each other, and thus we can bring to an end the fragmentation implicit in the current attitude toward the atomic point of view, which leads us to divide everything from everything in a thoroughgoing way. Nevertheless, we can comprehend that aspect of atomism which still provides a correct and valid form of insight; i.e. that in spite of the undivided wholeness in flowing movement, the various patterns that can be abstracted from it have a certain relative autonomy and stability, which is indeed provided for by the universal law of the flowing movement. Now, however, we have the limits of this autonomy and stability sharply in mind.' (Bohm, 1980, p. 14)

Thus, the entrepreneurial process can be seen from the perspective of a flowing movement punctuated by events. This shall be discussed further in later section. In the case of entrepreneurial venturing, we are adopting various forms of insights to enable us to understand how opportunities appearing in the stream of consciousness, being observed or created will lead entrepreneurs to actionable realizations. Bohm further adds that "Not only is everything changing, but all is flux" (Bohm, 1980, p. 61).

'The best image of process is perhaps that of the flowing stream, whose substance is never the same. On this stream, one may see an ever-changing pattern of vortices, ripples, waves, splashes, etc., which evidently have no independent existence as such. Rather, they are abstracted from the flowing movement, arising and vanishing in the total process of the flow. Such transitory subsistence as may be possessed by these abstracted forms implies only a relative independence or autonomy of behaviour, rather than absolutely independent existence as ultimate substances. Of course, modern physics states that actual

streams (e.g., of water) are composed of atoms, which are in turn composed of 'elementary particles', such as electrons, protons, neutrons, etc. For a long time, it was thought that these latter are the 'ultimate substance' of the whole of reality, and that all flowing movements, such as those of streams, must reduce to forms abstracted from the motions through space of collections of interacting particles. However, it has been found that even the 'elementary particles' can be created, annihilated and transformed, and this indicates that not even these can be ultimate substances but, rather, that they too are relatively constant forms, abstracted from some deeper level of movement. One may suppose that this deeper level of movement may be analysable into yet finer particles which will perhaps turn out to be the ultimate substance of the whole of reality. However, the notion that all is flux, into which we are inquiring here, denies such a supposition. Rather, it implies that any describable event, object, entity, etc., is an abstraction from an unknown and undefinable totality of flowing movement. This means that no matter how far our knowledge of the laws of physics may go, the content of these laws will still deal with such abstractions, having only a relative independence of existence and independence of behaviour.' (Bohm, 1980, p. 61)

Bohm indicates here that in his view there are no absolutely independent parts of reality, we can only find a relative autonomy, in relations to other part; never a complete one when we look at different aspects. There is a multi-dimensionality to observation from different aspects. The notion that all is flux 'implies that any describable event, object, entity, etc., is an abstraction from an unknown and undefinable totality of flowing movement.' (Bohm, 2002, p. 62). The objects of physics will always be treated as if they were independent of the rest of reality but as we can see here Bohm argues that any 'object' is only a relatively independent abstraction from the total flux. This view indicates that reality is not completely describable by any set of ultimate substances;

'So one will not be led to suppose that all properties of collections of objects, events, etc., will have to be explainable in terms of some knowable set of ultimate substances. At any stage, further properties of such collections may arise, whose ultimate ground is to be regarded as the unknown totality of the universal flux.' (Bohm, 2002, p. 62)

Active information

'These new properties suggest that the field may be regarded as containing objective and active information, and that the activity of this information is similar in certain key ways to the activity of information in our ordinary subjective experience' (Bohm, 1990 p. 271).

In Bohm's theory, active information (Bohm, 1990) is contained in a quantum field giving rise to a unique quantum potential. The movement of potential between these categories is actually quite subtle and he uses various analogies like radar waves and the waves at sea to describe it.

'...active information that plays a key role in this context. The word in-form is here taken in its literal meaning, i.e. to put form into (rather than in its technical meaning in information theory as negentropy). One may think of the electron as moving under its own energy. The quantum potential then acts to put form into its motion, and this form is related to the form of the wave from which the quantum potential is derived. There are many analogies to the notion of active information in our general experience. Thus, consider a ship on automatic pilot guided by radar waves. The ship is not pushed and pulled mechanically by these waves. Rather, the form of the waves is picked up, and with the aid of the whole system, this gives a corresponding shape and form to the movement of the ship under its own power. Similarly, the form of radio waves as broadcast from a station can carry the form of music or speech. The energy of the sound that we hear comes from the relatively unformed energy in the power plug, but its form comes from the activity of the form of the radio wave; a similar process occurs with a computer which is guiding machinery. The 'in-formation' is in the programme, but its activity gives shape and form to the movement of the machinery. Likewise, in a living cell, current theories say that the form of the DNA molecule acts to give shape and form to the synthesis of proteins (by being transferred to molecules of RNA).' (Bohm, 1990 p. 279)

What therefore drives subsequent actions following the subjective experience? 'This is in certain ways similar to Bohr's notion of wholeness, but it is different in that it can be understood in terms of the concept of a particle whose motion is guided by active information.' (Bohm, 1990 p. 280)

Bohm's notion of active information has great ramifications in the way how this active information affects the subjective experiences and subsequently motion which is guided by active information. On entrepreneurial terms, can this active information possibly be signalling to guide entrepreneurial actions? This shall be further explored in the discussion section.

Aspects of holograms and holomovement

Even knowledge, in Bohm's view is part of the flux. The view that all is flux must necessarily mean that even knowledge is to be treated as a process in a continuously flowing part of the total flux.

'the notion of process implies concerning the nature of reality, let us now consider how this notion should bear on the nature of knowledge. Clearly, to be consistent, one has to say that knowledge, too, is a process, an abstraction from the one total flux, which latter is therefore the ground both of reality and of knowledge of this reality. Of course, one may fairly readily verbalize such a notion, but in actual fact it is very difficult not to fall into the almost universal tendency to treat our knowledge as a set of basically fixed truths, and thus not of the nature of process (e.g., one may admit that knowledge is always changing but say that it is accumulative, thus implying that its basic elements are permanent truths which we have to discover). Indeed, even to assert any absolutely invariant element of knowledge (such as 'all is flux') is to establish in the field of knowledge something that is permanent; but if all is flux, then every part of knowledge must have its being as an abstracted form in the process of becoming, so that there can be no absolutely invariant elements of knowledge.' (Bohm, 2002, p. 63)

Such knowledge is part of flux and enfolded within it as part of reality, hence part of the hologrammatic representation.

'...we are led to suggest that the quantum theory indicates the need for yet another new order, which we call "enfolded" or "implicate". One of the striking examples of the implicate order is to be seen by considering the function of the hologram, which clearly reveals how a total content (in principle extending over the whole of space and time) is "enfolded" in the movement of waves (electromagnetic and other kinds) in any given region. We then come to the notion that the quantum theory indicates that this implicate order is not merely a dependent or fortuitous feature of the content, but rather, that it should be considered as the independent ground of existence of things, while the ordinary explicate order is what should be considered as dependent.' (Bohm, 1973 p. 139)

Holomovement has features that can describe actions and movement within the entrepreneurial process; while opportunities can be presented as a hologram. The key features of a functioning hologram where each region of space is defined as:

'... the order of a whole illuminated structure is "enfolded" and "carried in the movement of light... In all cases, the content or meaning that is "enfolded" and "carried" is primarily an order and a measure, permitting the development of a structure... but with the hologram, far more subtle structures can be involved in this way (notably three-dimensional structures, visible from many points of view).' (Bohm, 1973 p. 149).

Holomovement is a continuous and undivided totality that carries an implicate order (Bohm, 2002) and in certain cases, we can abstract particular segment of the holomovement but more generally, all forms of the holomovement merge and are inseparable. Holomovement is thus 'the label' Bohm puts on the total flux, it cannot be measured

since it is unbounded and as we have seen earlier, measure presupposes a boundary. "The holomovement is undefinable and immeasurable." (Bohm, 2002, p. 191)

The holomovement brings together the concept of "undivided wholeness" with the idea that emergent events along time is in a state of process or becoming in a flux flow. Wholeness is a dynamic oneness where it is "wholeness-in-motion" in which everything moves together in an interconnected process (Bohm, 1980).

Sensemaking, in Bohm's terms

Bohm introduces the word, 'soma-significance' (Bohm, 2006) . In his theoretical treatment, 'soma', which means body or matter, is connected with 'significance' or meaning.

'The notion of soma-significance implies that soma (or the physical) and its significance (which is mental) are not in any sense separately existent, but rather that they are two aspects of one over-all reality' (Bohm, 2006 p. 73).

Although we know, tacitly, what we mean when we consider meaning, and this will unfold and change as we consider it. In this case, the effect is very similar to effectuation and bricolage where the entrepreneurs co-create the future as it unfolds. Meaning, and the notion of the implicate order are, hence, closely related and this is the part where the enfolding and explicating actions of the implicate-explicate iterative process produces the generative emergence, as described by Lichtenstein (Lichtenstein, 2014). The emergence of new orders can use the iterative implicate-explicate order to explain. This order is not to be understood solely in terms of the usual regular arrangement of objects or as a regular arrangement of events. Rather, a total order is contained, in some implicit sense, in each region of space and time. This means "to fold inward". This leads to the exploration of the notion that in some sense each region or abstract of that continuum contains a total structure "enfolded" within it. In the television signalling broadcast, the visual image is codified into pulses, which is "carried" by the radio wave. The wave carries the visual image, the content within it, in an implicate order. The function of the receiver is then to explicate this order meaning to "unfold" it in the form of a new visual image (Bohm, 1973). The implicate order can thus explain how meaning is organized. As with the whole idea of the enfolding-unfolding iterative process, the unbroken wholeness provides the essential perspective as to how entrepreneurs make sense of the entrepreneurial process.

DISCUSSION

The concept of wholeness and implicate order are relatable to entrepreneurial venturing in space, in time, immersed in some degree of uncertainties. The fundamental assumptions underlying theories of entrepreneurial actions is that entrepreneurs operate in uncertain environment (Townsend et al., 2018).

'And yet, nearly a century since the unveiling of Knightian uncertainty as a precursor to profit-making, the identification, description, and operationalization of uncertainty as a construct continue to exhibit conflicting definitions, tautological measures, and unwitting conflation with more precise constructs along the spectrum of ignorance and unknowingness' (Townsend et al., 2018, p. 659)

Specifically, this paper will explore the many commonalities and overlapping relevance to Bohm's implicate and explicate orders which lead to something important in physics on one side and entrepreneurship on the other because they are explaining natural phenomena.

In (Bohm, 1980), Bohm presented a world-view where movement is fundamental. This view is radically different from our ordinarily conceptualized mechanistic world-view, and we have to reinterpret many of our daily concepts and perceive the world differently if we are to align with Bohm's thoughts. In Bohm's view movement is fundamental together with the conceptualization of flux . Entrepreneurial journey is a process over time, fundamentally it can also be viewed in movement.

Mcmullen and Dimov propose 'for a shift in inquiry from entrepreneurship as an act to entrepreneurship as a journey can facilitate process-oriented research by initiating a dialogue about the nature of the entrepreneurial journey, when it has begun and ended, whether it might be productively subdivided into variables or events, and what if anything remains constant throughout the process.' (Mcmullen & Dimov, 2013, p. 1481). Whether the process is subdivided into variables as entrepreneurial events, they can be seen as abstractions from the one total flux (Bohm, 2002). The entrepreneurial process

encapsulates and embraces all the functions, activities, and actions associated with the perception of opportunities and the entrepreneurial venturing is the pursuit of these opportunities (Bygrave & Hofer, 1992).

So how are the opportunities perceived in this universal flux of events and processes? In (Bohm, 2002), Bohm uses the notions to describe how the appearances of such phenomena might be presented differently, or characterized by varying principal factors, depending on contexts and observations. In this paper, we are presenting the idea of opportunity-as-hologram where the implicate, in its "enfolded" order is seen as a deeper layer in a fundamental order of observable reality because they contained within it the past experiences and knowledge that will shape the course these entrepreneurs will take. The explicate or "unfolded" order is the generative emergence, a new pathway that opens up as a result of certain actions taken by the entrepreneurs.

The emphasis on how entrepreneurs pursue real, artificial or even imagined opportunities or futures 'as if' they are real (Gartner et al., 2016) in order to exploit and bridge the gap to capitalize on the opportunity tension. According to Lichtenstein in (Lichtenstein, 2014), ultimately the key to generative emergence is the observation of the opportunity tension—a viability and feasibility matched by an internal passion and motivation to enact it. The holographic representation of the opportunity-as-hologram will have both the implicate order (referring to past experience and knowledge) and explicated reality including the entrepreneurs' internal orientation, including self-efficacy (Palmer et al., 2019), creativity (Dimov, 2007), innovativeness (Rauch & Frese, 2007) embedded within it. The opportunity-as-hologram must be deemed feasible to be captured and exploited. In other words, self-reflexivity is the capacity of the entrepreneurs to assess the present state and its conditions (contingent experience) relative to implicate order (memories, prior actions, prior knowledge and experience) and what is envisioned and anticipated in the future (anticipation of the explicate order).

'The past is embedded in an enacted means-end artifact (emergent outcome) in terms of (1) what is intended to happen in the future; (2) what should be done in the present; and (3) what is expected to happen in the present. The present, on the other hand, relates to the ongoing experience of contingent events (fluctuations), including path-dependent feedback from prior actions. The interacting components of a sense-making subsystem are, therefore, the ongoing relationship between the past and present dimensions of the entrepreneurial journey' (Selden & Fletcher, 2015, p. 8).

Bohm's implicate-explicate order forges a new path of emergence and can thus explain the entrepreneurial process as flux in relations to opportunity-as-hologram signalling to the entrepreneurs and triggering entrepreneurial self-organization of new emergent patterns.

These emergent patterns are much of what entrepreneurs think about in venture creation which is not an isolated event but a holistic one with a past or the "enfolded" order and with a vision of a future. New venture creation is described as an iterative and interactive in a dynamic process not just a linear, non-interacting journey' (Davidsson & Gruenhagen, 2020). On the entrepreneurial enactment (Jack et al., 2008), entrepreneurs carry from their memories record of past experience, prior knowledge, of critical incidents and their learning points. Their thoughts are therefore coloured with these perspectives and at the same time conditioned by such limits, bounded rationality (Hogarth & Karelaia, 2012)(Kahneman, 2003). Prior knowledge, experience with 'knowledge corridor' (Shane, 2000), when applied in Bohm's terms are enfolded and then explicate into a new pathway. The embodiment of knowledge, prior experience in the "knowledge corridor" are enfolded into the holographic representation of opportunity. Entrepreneurs interpret their experiences through a concoctions of conscious and unconscious memories enfolded in the implicate-explicate order to later go into some form of sensemaking and self-organization. Entrepreneurs act on the opportunities, whether real or artificial is irrelevant, as it spurs actions and this enactment leads to unexpected and sometimes unimagined results.

Implicate-explicate iterations in entrepreneurial process

'In the diversity of entrepreneurial literatures that may be useful for the understanding of entrepreneurial process flux dynamics can provide a novel way to observe entrepreneurial process. With linearity and the arrow of time in a one-directional flux motion, the entrepreneurs experience the explicate orders- the unfolding of the future. This happens because, just as the implicate order unfolds to give rise to the explicate reality over time, our mind enfolds the explicate order back into the implicate order of conscious memory (Bohm, 1973). Bohm uses the perception of music and melody as an illustration. On hearing each note, hearing is not experienced in isolation but in terms of the context of all the notes that have come before it in the composition. As each new note is heard, it is enfolded into the ongoing consciousness of the music, building up a mental structure which creates expectations reaching forward into the future in the hope to reach a crescendo. The implicate order drives the reverse of this process: each moment

of explicate reality is enfolded within the implicate order, becoming manifest as it is unfolded (Bohm, 1973). The rolling forward and unfolding in the explicate reality is at the same time enfolded within the implicate order (rolling backward through introspection), becoming manifested as it unfolds. The “rolling forward-rolling-backwards” vacillation shapes actions through adaptation. Entrepreneurial actions, are continuously developing, are enfolded in the implicate order (through past and prior actions and experience) and then to unfold into the explicate reality. In this paper, inquiry into the question of time and the emergence of actions in entrepreneurship and the adaptation of the actions to accommodate the shifted contexts in the socio-material network. The heterogeneity of the entrepreneurial socio-material network plays a crucial part in the behaviour of the entrepreneurs as it provides the contexts for adaptative changes with obstacles or the lack of resources. Entrepreneurs manage the pathway development as they move along the time continuum. The cumulative capacities, including experience and prior actions of the entrepreneurs become a structuring force of the network by feeding the entrepreneurial process. The task of the entrepreneurial venturing is then taken to accommodate new observations, of internal and external resources, networks and external helps, by means of adaptations within the ecosystem, so as to fit the new facts and to adapt over time. Summarily, the actions undertaken by entrepreneurs in the socio-material network involves two complementary movements over time along the entrepreneurial pathway – accommodation and assimilation (Bohm, 1973). Where accommodation is taken to mean fitting, cutting to a pattern, adapting, imitating and conforming to new situation, assimilation is taken to mean digest and “to-take-into”, the two complementary movements along the entrepreneurial pathway and process are part of the “rolling forward-rolling-backwards” to create new reality over time.

The enfolding or implicate order (rolling backward) to the explicate order (rolling forward) action mould the time experience and is best encapsulated by (Bohm, 1973) where he inquired into the question of emergence of new orders in physics. His theorization of the state of emergence is useful in the conceptualization of emergence of time from a present state to the future state.

‘One of the most striking examples of the implicate order is to be seen by considering the function of the hologram which clearly reveals how a total content (in principle extending over the whole of space and time) is “enfolded” in the movement of waves (electromagnetic and other kinds) in any given region. We then come to the notion that the quantum theory indicates that this implicate order is not merely a dependent or fortuitous feature of the content, but rather, that it should be considered as the independent ground of existence of things, while the ordinary explicate order is what should be considered as dependent.’ (Bohm, 1973, p. 139).

The perspective of time has a certain orderliness – moving unidirectionally and irreversibly in a forward direction and as it moves, always creates a past with a present “now” and an unfolding future. A general feature of such time-development in the three phases (past, present and future) has certain basic notion of order as permanent, unchangeable and irreversible. Where entrepreneurial venturing is concerned in this respect is the task of accommodating new observations of externalities including the recognition of opportunities in the present and by means of adaptations within these basic notions of order of past, present and future so as to fit new facts in the current observed reality and then to craft the next step into the future. It may thus be inferred that entrepreneurial adaptation (Messier & Puettmann, 2011), assimilation and accommodation of new facts and observations within the “present state” is the main activity and concern of the entrepreneurs and then to decide on the shape of things to come which can have many possibilities. To assimilate and to accommodate known orders of thoughts and experiences from the past and in the act of assimilation of new facts and information, including discovery of new opportunities to roll forward into the future is an exercise of entrepreneurial venturing. In order to understand what is the proper role of accommodation and assimilation of facts within the environmental contexts or ecosystem (Kuckertz, 2019), it is important to note that facts or even opportunities as perceived by entrepreneurs (Dimov, 2011) may not be independent existential object as they may be figment or imagination in the minds of the entrepreneurs and exist as artefact described by Simon Herbert in the “The Sciences of the Artificial” (Warner & Simon, 1969) (Sarasvathy, 2003). Thus in a certain sense, entrepreneurs “make” the fact as they understand them or summarily, with the immediate observation of the actual situation, entrepreneurs ascribe meanings – or sensemaking (Weick et al., 2005) and develop the fact by providing order, form and structure with the aids of their existing knowledge and experiences. It is this constant “rolling-backing-rolling-forward” iterations with perception, discovery, creation and co-creation (Garud et al., 2014) by the entrepreneurs that should properly be interwoven continually with the present “now” activities; coupled with accommodation and assimilation of the past knowledge and experience into giving shape of what is to come in the future, forging a new conceptual understanding and notion of order of time in entrepreneurship.’ (Leong, 2021, pg 1-2).

The implicate-explicate order, with reference to time, can be operationalized to explain the venture emergence process particularly the critical events/ incidences in the emergent path of an entrepreneurial journey. Where

Bohm's scheme suggests that past events can in a way exist in an enfolded manner where these past events and prior experience are "rolled-backwards" and enfolded into new explicate orders in the form of critical event. A variety of researches have established and recognized that failure, being a critical event is common among entrepreneurs. These past failure events and prior experience positively affects opportunity discovery and opportunity exploitation (Rerup, 2005). The events of phase transitions and shifts into new patterns of emergence are associated with the transformation of means–end relationships. The means, here refer to the social-material resources or the resource bundles at the disposal of the entrepreneurs to direct their efforts to achieve their ends. The transformations to the critical events rest entirely on the specific set of entrepreneurial actions and activities in the critical event/ incidence:

'We understand transformation here to refer to either (1) redefining means–end relationships in the sense of initiating a new pattern of emergence by altering the business idea, or (2) recontextualizing means–end relationships in the sense of initiating a new pattern of emergence by re-testing the business idea in a new subsystem context. The key to identifying and explaining the critical events of phase transitions is to focus on how means–end artifacts are redefined or recontextualized at the boundary interface of the entrepreneur's sense-making system.' (Selden & Fletcher, 2015, p. 8)

The implicate order is the ground from which reality emerges (Carvallo, 1992). Hence, any entrepreneurial event, particularly those critical events in the implicate-explicate order of the entrepreneurial flux, sense-making is paramount. The principle function of the entrepreneurs' sense-making in the venture emergence is to contextualize the path of the entrepreneurial journey by creating, contingently evaluating, enacting, practicing and transforming the means–end relationships that constitute entrepreneurial artifacts within the flux (Selden & Fletcher, 2015). Bohm further adds: 'within this deeper order forms are enfolded within each other so systems which may be well separated in the explicate order are contained within each other in the implicate order. In a simplistic sense the implicate and explicate orders could be seen as dual forms related by an integral transform. Yet Bohm gives the implicate order a much deeper status and suggests that is the ground out of which reality emerges. Indeed there may be a whole hierarchy of implicate orders, each more subtle than the other. The implicate order therefore provides a powerful image of a general sort of non-locality which may apply not only to a discussion of the material world but also to the activity of the mind.' (Carvallo, 2013)'

Holomovement in entrepreneurial flux, process and events

In Selden and Fletcher conceptualize the entrepreneurial journey as an 'emergent hierarchical system of entrepreneurial artifact-creating processes' (Selden & Fletcher, 2015) and added that entrepreneurial process can be explained in relation to the endogenous dynamics of prior patterns of artifact emergence. Bohm's approach reveals how significant it is not to underestimate the intrinsic undivided wholeness in enfolding-unfolding order. In the entrepreneurial process it behaves like a flux flow where entrepreneurial events, knowledge, risks, opportunities and all describable artifacts are in state of change, of "becoming" depending on actions adopted by the entrepreneurs. Hence, to liken entrepreneurial process as flux where all the 'prior patterns' are enfolded and then are unfolded into the 'becoming', of artifact emergence or in Lichtenstein's terms generative emergence (Lichtenstein, 2014).

'...the notion of process implies concerning the nature of reality, let us now consider how this notion should bear on the nature of knowledge. Clearly, to be consistent, one has to say that knowledge, too, is a process, an abstraction from the one total flux, which latter is therefore the ground both of reality and of knowledge of this reality. Of course, one may fairly readily verbalize such a notion, but in actual fact it is very difficult not to fall into the almost universal tendency to treat our knowledge as a set of basically fixed truths, and thus not of the nature of process (e.g., one may admit that knowledge is always changing but say that it is accumulative, thus implying that its basic elements are permanent truths which we have to discover). Indeed, even to assert any absolutely invariant element of knowledge (such as 'all is flux') is to establish in the field of knowledge something that is permanent; but if all is flux, then every part of knowledge must have its being as an abstracted form in the process of becoming, so that there can be no absolutely invariant elements of knowledge.' (Bohm, 2002, p. 63)

The process-orientation of the entrepreneurial venturing can be likened to the idea of 'all is flux' where the process is constantly in the state 'of-becoming' with past knowledge from the 'knowledge corridor' (Gruber et al., 2013) together with new observed knowledge from the environment being part of the flux unfolded (or explicated) as new emergence.

'...founding teams with more diverse industry experience and more diverse external knowledge sourcing relationships identify not only a larger number of but, in particular, more varied (distant) market opportunities. However, the extent to which strategic variety of such opportunities is identified depends on the founders' technological expertise, whereas technological expertise is less relevant in identification of the number of opportunities. Furthermore, by showing that the extent and nature of the firm's pre-entry opportunity set has a significant effect on the likelihood of subsequent firm diversification, we document how initial constraints in founders' choice sets can have a lasting impact on the growth potential that the new firm exploits over time.' (Gruber et al., 2013, p. 280)

In here, it is clear that prior industry experience, past knowledge from the 'knowledge corridor', their technological expertise, new information perceived from the market as market opportunities are part of the artifacts in the flux; and where:

'every part of knowledge must have its being as an abstracted form in the process of becoming, so that there can be no absolutely invariant elements of knowledge.' (Bohm, 2002, p. 63)

This flux can be interpreted as the holomovement which is continuous and undivided totality and embeds the implicate order (Bohm, 2002, p. 191). In certain cases, we can abstract particular segments of the holomovement but in general, all forms of the holomovement fuse and are inseparable. Holomovement is thus 'the label' Bohm puts on the total flux, it cannot be measured since it is unbounded and as we have seen earlier, measure presupposes a boundary. "The holomovement is undefinable and immeasurable." (Bohm, 2002, p. 191)

The holomovement brings together the holistic principle of 'undivided wholeness'. The idea that everything is in a state of process or flux is the central tenet in this conceptualization. Wholeness is not a static oneness. It is a dynamic wholeness-in-motion in which everything moves together in tandem, in an interconnected process (Bohm, 1980). To contextualize this on entrepreneurial-process terms, every journey is unique with a different flux flow. To understand the unique entrepreneurial journey from the process view is to take into account that counterfactual possibilities in every event of the journey change (Selden & Fletcher, 2015). The entire flux flow of events of an entrepreneurial journey with behaviours, patterns, external perturbations, shocks and structures, contingencies are interpreted to be the "undivided wholeness" and new emergent possibilities open as entrepreneurs act, either creatively (Dimov, 2007), intuitively (Randerson et al., 2016) or in the case of self-reflexivity (Sarason et al., 2006). The process literature is rich in explanations of nonlinear pathways of emergence (Lichtenstein, 2009), path-dependency (Garud et al., 2010), external shocks (Shepherd et al., 2000), opportunities (Davidsson, 2015), risks (Sarasvathy, 2004) (Villot, 2011) (Villot, 2011), creativity and self-reflexivity. The conceptualization of the entrepreneurial journey as an emergent process in which such artifacts are part of the wholeness in the flux; it implies that every part of flux is an an abstracted form in the process of becoming (Bohm, 2002, p. 63).

This wholeness concept in the 'holomovement is undefinable and immeasurable' (Bohm, 2002, p. 191) but they are the reasons why any actions taken by the entrepreneurs at the entrepreneurial events produce generative emergence which are equally undefinable and immeasurable, hence the future is not certain (Sarasvathy & Dew, 2005). 'The inherent uncertainty, nonlinearity and lack of predictability in a cycle of emergence make this proposal risky at best.' (Lichtenstein, 2014). The wholeness, implicate-explicate order can therefore be interpreted as a holistic conception of the entrepreneurial journey explaining the emergence and unfolding of the entrepreneurial events.

Opportunity-as-hologram, real or artificial?

Holomovement has features that can describe actions and movement within the entrepreneurial process; while opportunities can be presented as a hologram. The key features of a functioning hologram where each region of space can be described as:

'... the order of a whole illuminated structure is "enfolded" and "carried in the movement of light... In all cases, the content or meaning that is "enfolded" and "carried" is primarily an order and a measure, permitting the development of a structure... but with the hologram, far more subtle structures can be involved in this way (notably three-dimensional structures, visible from many points of view).' (Bohm, 1973 p. 149).

With such understanding, the opportunities are therefore to be presented in the form of a holographic representation, with all the past experience, knowledges as valuable for seeding strategies to adapt to venture pathway development (Ott et al., 2017) enfolded within in with the promise of future profits through its envisaging. The holographic nature and descriptions of opportunities seen in this way will therefore shift the debate if opportunities are real or artificial as they are no longer relevant as they are signal to pull the entrepreneurs to actionable exploitations.

Bohm's idea of holographic paradigm provides a novel way of understanding the many phenomena ranging from quantum physics to social sciences, and in this case to the workings of the entrepreneur's way of perception and awareness or perceptiveness to opportunities. Can opportunities be therefore seen to be as such – as holographic. Opportunities, defined along the lines of discovery and creation, by bricolage or effectuation, these are, at best descriptions of the opportunity types arising from certain contexts. From here, on the appearance of the opportunities as artefact in the form of holographic representation, real or artificial, they contain within the hologram "information... is enfolded into every part" (Mackenzie, 1991)

Borrowing ideas from holographic photography, the hologram is Bohm's favourite metaphor for conveying the structure of the implicate order. Holography relies upon wave interference. If two wavelengths of light are of differing frequencies, they will interfere with each other and create a pattern. 'Because a hologram is recording detail down to the wavelength of light itself, it is also a dense information storage.' (Storoy, 2014) Bohm notes that the hologram clearly reveals how a "total content—in principle extending over the whole of space and time—is enfolded in the movement of waves (electromagnetic and other kinds) in any given region." The hologram illustrates how "information about the entire holographic scene is enfolded into every part of the film." It resembles the implicate order in the sense that every point on the film is "completely determined by the overall configuration of the interference patterns." Even a tiny chunk of the holographic film will reveal the unfolded form of an entire three-dimensional object. Proceeding from his holographic analogy, Bohm proposes a new order—the implicate order where "everything is enfolded into everything." This is in contrast to the explicate order where things are unfolded. Bohm puts it thus:

"The actual order (the implicate order) itself has been recorded in the complex movement of electromagnetic fields, in the form of light waves. Such movement of light waves is present everywhere and in principle enfolds the entire universe of space and time in each region. This enfoldment and unfoldment takes place not only in the movement of the electromagnetic field but also in that of other fields (electronic, protonic, etc.). These fields obey quantum-mechanical laws, implying the properties of discontinuity and non-locality. The totality of the movement of enfoldment and unfoldment may go immensely beyond what has revealed itself to our observations. We call this totality by the name holomovement." (Bohm, 2002, p. 225)

Bohm notes that the hologram clearly reveals how a "total content, in principle extending over the whole of space and time, is enfolded in the movement of waves (electromagnetic and other kinds) in any given region." The hologram illustrates how "information about the entire holographed scene is enfolded into every part of the film." It resembles the implicate order in the sense that every point on the film is "completely determined by the overall configuration of the interference patterns." From the perspective of "total content" this can include:

'... locational advantages, alongside the advantages of control-power, dynamic transaction costs, and capabilities of organization in effecting value appropriation, often through market and ecosystem creation and co-creation' (Pitelis, 2012, p. 1376).

Hence, in this paper, we are arguing on the premise that opportunity-as-hologram will dispel arguments of whether they are real or artificial, existing or imagination (Berglund et al., 2020). Both of these discovered opportunity and created opportunity can be embraced by opportunity-as-hologram concept. Opportunity viability and attractiveness are embedded within the holographic representation and the opportunity potential is detected by the entrepreneurs.

On alertness and awareness of opportunity

Bohm conceives of consciousness as more than information; rather it is information that enters into consciousness and awareness. For Bohm consciousness “involves awareness, attention, perception, acts of understanding, and perhaps yet more.” Further, Bohm parallels the activity of consciousness with that of the implicate order in general. Consciousness, Bohm notes, can be “described in terms of a series of moments.” Basically, “one moment gives rise to the next, in which context that was previously implicate is now explicate while the previous explicate content has become implicate.” Consciousness is an interchange; it is a feedback process that results in a growing accumulation of understanding.

Entrepreneurial alertness is not about the objective realization of an opportunity as envisaged by (Kirzner, 1973). Exploring heuristics and biases can provide certain understandings on how entrepreneurs process information that in turn affects their decision to create new ventures or new venture pathways (Keh et al., 2002). Idiosyncratic knowledge and experiences that the entrepreneurs take to bear on the opportunity recognition process including the attention to that opportunity must be the starting and initial conditions for actions.

Active information signalling entrepreneurial action?

The role of perfect or rather imperfect information shapes entrepreneurial decision. On how active information induce entrepreneurial actions needs to be explored. The actions of the entrepreneurs are triggered by signals – signals provided in the active information within the opportunities and the entrepreneurs must therefore see the quantum potentials within the set of information or opportunities to decide to act or not to act. The word ‘signal’ contains the word ‘sign’, which means ‘to point to something’ as well as ‘to have significance’.

In Bohm’s theory, active information (Bohm, 1990) is contained in a quantum field giving rise to a unique quantum potential this can be translated into entrepreneurial potential that can excite the entrepreneurs.

‘These new properties suggest that the field may be regarded as containing objective and active information, and that the activity of this information is similar in certain key ways to the activity of information in our ordinary subjective experience’ (Bohm, 1990 p. 271)

This shows how active information affects the subjective experiences.

‘It follows from the above that the possibilities for wholeness in the quantum theory have an objective significance. This is in contrast to what happens in classical physics, which must treat a whole as merely a convenient way of thinking about what is considered to be in reality nothing but a collection of independent parts in a mechanical kind of interaction. On the other hand, in the quantum theory, the ‘ballet-like’ behaviour in superconductivity, for example, is clearly more like that of an organism than like that of mechanism. Indeed, going further, the whole notion of active information suggests a rudimentary mind-like behaviour of matter, for an essential quality of mind is just the activity of form, rather than of substance. Thus, for example, when we read a printed page, we do not assimilate the substance of the paper, but only the forms of the letters, and it is these forms which give rise to an information content in the reader which is manifested actively in his or her subsequent activities. A similar mind-like quality of matter reveals itself strongly at the quantum level, in the sense that the form of the wave function manifests itself in the movements of the particles. This quality does not, however, appear to a significant extent at the level at which classical physics is a valid approximation.’ (Bohm, 1990 p. 281)

When seeing opportunity-as-hologram, the active information within the hologram can be seen as signalling and cueing the entrepreneurs to action in a pre-action stage. Active information can thus serve as a mediating link or connection between these two sides of reality as a whole. (Bohm, 1990) and thus motivates the entrepreneurs to act by crossing the bridge.

‘To bring this about, one could begin by supposing, for example, that as the quantum potential constitutes active information that can give form to the movements of the particles, so there is a super quantum potential that can give form to the unfoldment and development of this first order quantum potential.’ (Bohm, 1990 p. 283)

Bohm's quantum potential can be seen as an internal energy within a quantum system (Dennis et al., 2015). To contextualize to entrepreneurial application, within the active information, entrepreneurs sense the quantum potential equivalent to the description of opportunity potential or propensity described in (Ramoglou, S & Tsang, E, 2015). Ramoglou and Tsang advance the actualization approach which theorize opportunities as unactualized propensities.

To this end, it's the final action that gives form to the movements and motions in the entrepreneurial process or flux flow. Seeing opportunities form certain beliefs and convictions for actions on account of the sustained attention and alertness (Shepherd et al., 2017).

Perceiving the opportunity-as-hologram, with all the embedded knowledges, prior experiences in the "knowledge corridor", this is nonetheless still in the pre-action stage. The sustained attention, through alertness, may help entrepreneurs notice the signal but not sufficient to form an opportunity belief for strategic action (Shepherd et al., 2017).

The flow of information between the various levels and their meanings must be comprehended by the entrepreneurs in a process which, Bohm suggests, may lead on to a grasp of very subtle meanings in a flash of insight (Bohm, 2006). This flash of insight can be what eventually inspired the entrepreneurs to act. This flash of insight, recognition of the active information and opportunity potential, in opportunity-in-hologram may be treated as the signal and cue that motivates the entrepreneurs to action.

In terms of the implicate or enfolded order where the interpretations of meanings of the active information at the various levels is significant and in fact is core to this holographic description of opportunity. As these active information enfold and are unfolded, each part of the enfolding and unfolding has a significant bearing on each other. Meanings can then be seen as a constantly extending and actualizing structure -it is never complete or fixed but constantly evolving. As with the case of effectuation and bricolage (Fisher, 2012), the development of the venture pathway is evolving depending on what the entrepreneurs make of it by interacting and co-creating with environment to form opportunities. Or use resources on hand to solve an existing problem in a novel way or to create a new mean-end relationship. Entrepreneurial improvisation (Alvarez et al., 2016). Bricoleurs draw from unrelated or underdeveloped resources to form new combinations during opportunity-formation process hence it represents value creation to some extent. This can only take place, in entrepreneurial experience, when new meanings are being perceived freshly from moment to moment (Bohm, 2006) as the entrepreneurs move into various stages of the entrepreneurial process:

‘takes part in the process of this totality, he is fundamentally changed in the very activity in which his aim is to change that reality which is the content of his consciousness.’ (Bohm, 2002, p. 266)

The "knowledge corridor" embedding prior experiences and knowledge form collective experience from the past, get enfolded, as part of the totality in the opportunity-as-hologram. It can only reorganise existing meanings and help entrepreneurs form opportunity beliefs for action.

Envisioning the future, is also part of the holographic representation of the opportunity. Entrepreneurs often perceive opportunities where others do not or fail to see and envision future possibilities that others fail to recognize or fail to act (Keh et al., 2002). An opportunity-as-hologram contains vision of the future state, drawn by the lure of profits. In a way the opportunity-as-hologram inspires and draws entrepreneurs to actions. Entrepreneurs must have a conviction to act with locus of control (Brandstätter, 2011)(Karabulut, 2016) and access to resources (Tiba et al., 2020) for the exploitative actions to follow. In short, the envisioning of the future within the opportunity-as-hologram induces entrepreneurial actions.

CONCLUSION

The study of entrepreneurship, in quantum terms hold some promise in providing a better fit to understand the entrepreneurial actions, phenomenologically through quantum terms. This paper's insights underscore the necessity to bring together varied streams of knowledge including quantum physics paradigms, in particular Bohm's implicate and explicate order to describe the movement, processes, self-organization, space-time, uncertainties and behaviours. These joint examination in quantum terms provide a framework to understand entrepreneurship around opportunity, environmental contexts and the actor who is the alert entrepreneur. This framework can support future conceptualizations

in the direction of quantum physics to describe the state of disequilibrium and chaos and the sensemaking of entrepreneurs as they traverse along the entrepreneurial journey which is in a state of flux.

This paper illustrates entrepreneurial opportunity-as-hologram perspective with active information and embedded opportunity potential inducing entrepreneurial to actions and have important implications for development of theory on quantum terms. Such quantum terms premising on uncertainties, flux and implicate and explicate order can frame the practice of entrepreneurship. Future researchers can use the concepts of active information and opportunity-as-hologram to discuss opportunity potential. Bohm uses the analogy of the seed being “informed” to produce a living plant. Life is enfolded in the totality and—even when it is not manifest, it is somehow implicit. The holomovement is the ground for both venture creation where the potentiality of the opportunities to be pursued is in the implicate order, pending the explication to reality and into the future.

‘... considering the growth of a living plant. This growth starts from a seed, but the seed contributes little or nothing to the actual material substance of the plant or to the energy needed to make it grow. This latter comes almost entirely from the soil, the water, the air and the sunlight. According to modern theories the seed contains information, in the form of DNA, and this information somehow ‘directs’ the environment to form a corresponding plant.’(Bohm, 2002, p. 245)

The concept of opportunity-as hologram, with regards to entrepreneurial discovery, creation or within the creation genre – effectuation and bricolage- is presented here to generate a framework for entrepreneurship based on implicate-explicate order. This is not to contest the practical usefulness of mentioned theories but rather to contextualize the potential of translating Bohm’s wholeness and implicate order concept into a certain quantum flux or entrepreneurial process. It is perhaps useful to explain the origin of the word ‘potential’ from both quantum physical and economic standpoints. The term is derived from a Latin root meaning ‘potentia’, which means ‘force’, ‘strength’ and ‘power’. The central underlying theme, implies emergent force or power within and this can lead the further discussion of entrepreneurial energy (Leong, 2020)(Leong, 2021a).

Any entrepreneurship theory is simply a way of seeing phenomena from a particular vantage point and the usefulness of theorizing is that it must be contingent on the particular circumstances – hence, the time, the place and the conditions to which it is applied are all relevant. When place, time and contexts/ conditions are taken together and applied with the entrepreneurial process, we are in fact situating time, space, conditions and process in the flux. Understanding entrepreneurial process as a flux can be an interesting start for research in entrepreneurial venturing.

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