

## RESEARCH ARTICLE



# Probabilistic Interpretation of Entrepreneurial Opportunity Using the Many-Worlds Model

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**Abstract:** This research engages with the uncertainties and unknowable in entrepreneurship with literature on the philosophy of quantum mechanics in an analogical way. Often characterized as a journey into an uncertain future, entrepreneurship stands out as a dynamic and unpredictable domain driven by a compelling and indefinable force. This research's central argument revolves around the notion that within the entrepreneurial landscape, many latent propensities exist, each carrying its distinct probability of manifesting into various outcomes. Unlike a deterministic process with a single predetermined outcome, entrepreneurship is a complex interplay of potentialities. To capture this multifaceted perspective, we leverage the principles and formalism of quantum mechanics, renowned for its emphasis on potentiality over actuality until subjected to observation and action. This philosophical framework describes the inherent potentialities embedded within entrepreneurial opportunities. This study introduces a groundbreaking Many-Worlds model inspired by the interpretations of quantum mechanics. In this model, the act of observation serves as a catalyst, unraveling a spectrum of potential outcomes, each characterized by its probability. These potentialities materialize based on entrepreneurs' intentional actions and decisions, reflecting their commitment to shaping the future of their ventures. In summary, our study bridges the gap between entrepreneurship and quantum mechanics by proposing a novel framework that portrays entrepreneurship as an exploration of a quantum-like landscape of possibilities. By emphasizing the significance of intentionality and action, our research sheds new light on entrepreneurship's dynamic and unpredictable nature, illustrating how entrepreneurs play a pivotal role in transforming potential into reality.

**Keywords:** entrepreneurship, quantum physics, Many-World interpretation, potentiality, uncertainty

## 1. Introduction

The fundamental idea of Many-Worlds interpretation originates in Everett in 1957 [1]. Numerous adaptations and reinterpretations have arisen in response to Everett's highly contentious proposition. Still, this paper borrows some key themes to formulate a Many-Worlds model in an entrepreneurial opportunity. This involves a prescription corresponding to the probabilistic state of opportunity-as-artifact and entrepreneurs' experiences [2]. Entrepreneurs are drawn to possibilities and profitable prospects, enthused and excited by the imagery's future state. Here, we postulate that the opportunity artifact has quantum property and presents Many-World possibilities and potentialities to the entrepreneur. This expands upon the propensity framework proposed by Ramoglou and Tsang [3], which likens opportunities to the inherent potential of a seed to develop into a flower. However, it is essential to note that we cannot directly observe the seed's intrinsic capabilities or the intricately intertwined, empirically unobservable generative processes [4]. This prompts us to question whether the observable opportunity is genuine or contrived [5].

It is a defining characteristic of open systems that combine two or more mechanisms, which may belong to radically different categories, to generate outcomes. Consequently, due to the lack of foreknowledge

regarding which mechanisms will be in operation (and sometimes without knowledge of how they interconnect), events cannot be deduced with certainty [6]. Observation is a vital criticality. An actual state emerges when observation is made or an object is perceived. An object not under observation is in a superposition state – in a composition of different (classical) states [7, 8]. According to this perspective, the transition of a state due to observation is regulated by probability functions that do not pertain to the underlying microscopic aspects of space and time but instead relate to the macroscopic objects perceived through our senses [9], considering prior knowledge and an awareness of current circumstantial information. This conceptualization stems from endeavors aimed at comprehending the seemingly irrational behaviors exhibited by entrepreneurs. We posit that these behaviors can be situated within the realm of quantum effects. In this context, the quantum realm should be envisioned as an ethereal domain, where its symbols, such as the wave function, symbolize potentiality rather than actuality [10].

One of the enduring and prevalent themes within theories of entrepreneurial action is the notion that entrepreneurs find themselves in various states of uncertainty while navigating an unpredictable business environment [11]. Uncertainty and indeterminacy are the primary challenges encountered in entrepreneurial ventures. Consequently, uncertainty is significant in developing quantum theory [12]. In this context, this paper aims to offer fresh insights into uncertainty and indeterminacy in

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entrepreneurship, utilizing a quantum concept like superposition. This concept mirrors the notion that mixed states, akin to suspended animation, are poised for actualization.

Fundamentally, quantum theory provides predictions concerning the likelihood that measurements of specific types will yield particular outcomes within defined circumstances [9]. It is worth noting that quantum theory often challenges our intuitive understanding, and much of the debate revolves around the difficulty of describing observations [10]. In the context of quantum mechanics, when observations occur, the quantum state of the observed subject transforms, a phenomenon encapsulated by the observer effect, which posits that the act of observation alters the situation or phenomenon being observed [7]. This concept finds extensive discourse in physics, where observation and uncertainty are fundamental aspects of quantum mechanics.

In the entrepreneurial domain, the act of observing opportunities assumes critical significance, serving as the foundation for all entrepreneurial endeavors and actions, ultimately leading to inherently probabilistic outcomes. This study investigates the various processes integral to entrepreneurship, including opportunity recognition, discovery, creation, and actualization, while also presenting a comprehensive review incorporating past critiques. Each of these concepts and processes involves a profound examination of the genesis of opportunities. Recognizing the limitations in the current definition of entrepreneurial opportunities, this study proposes a paradigm shift by redefining them as artifacts imbued with quantum properties. This proposition extends and refines the propensity framework for understanding opportunities, in which opportunities are likened to the latent potential of a seed to sprout into a flower [3, 13].

This study entails the construction of a framework inspired by the Many-Worlds interpretation, asserting that opportunities encompass embedded propensities, each characterized by varying probabilities of yielding diverse outcomes. These propensities are associated with unique conceptualizations of uncertainty, occasionally transcending the realms of measurable risk and rationality. The final section of this paper investigates the implications arising from the Many-Worlds model of the opportunity artifact. It underscores the necessity of expanding the research agenda beyond mere observation and decision-making, urging a shift toward entrepreneurial actions.

This conceptual study employs an interdisciplinary research approach that bridges the fields of quantum mechanics and entrepreneurship. This paper utilizes the Many-Worlds interpretation and principles from quantum theory as the foundation for constructing a theoretical framework that reconceptualizes entrepreneurial opportunities as quantum artifacts characterized by inherent potentialities. The paper's methodological process encompasses a comprehensive literature review to identify pertinent analogical references from quantum theory, including superposition and the observer effect. The study systematically draws connections between these quantum principles and the domain of entrepreneurship, emphasizing the resemblances and shared elements. Subsequently, the quantum framework is applied to specific entrepreneurial scenarios to illustrate how quantum analogies can provide insights into entrepreneurial decision-making, uncertainty management, and opportunity recognition. Through theoretical and practical deliberations, this paper delves into the implications of perceiving opportunities as quantum artifacts and proposes potential directions for future research. This methodological approach offers a fresh perspective on entrepreneurship, providing valuable insights into the transformative attributes of opportunities and their influence on entrepreneurial actions.

To summarize the paper's core thrust, firstly, it delineates the existing inadequacies in defining entrepreneurial opportunities, highlighting the ontological and epistemological challenges. In response, we propose a radical reimagining of opportunities as artifacts infused with multifaceted potentialities and propensities drawn from the Many-Worlds perspective. Secondly, the paper provides the conceptual underpinnings of the Many-Worlds interpretation. It applies it to construct a model for understanding entrepreneurial opportunities, employing quantum formalism to explore the probabilistic outcomes of entrepreneurial actions. Finally, the paper concludes by deliberating on the practicality and feasibility of this model, emphasizing its potential contributions to both theoretical and practical aspects of entrepreneurship.

## 2. Literature Review

Shane and Venkataraman [14] developed a conceptual framework centered on the concept of opportunity to assist entrepreneurship researchers in understanding the intricate web of factors that constitute entrepreneurship. This framework seeks to enhance the quality of empirical and theoretical work in the field by illuminating unexplained phenomena and improving the overall research quality [14]. It also serves the purpose of legitimizing the field of entrepreneurship and preventing its marginalization. The framework delineates two conceptual definitions of opportunity. The first, termed the "discovery approach," portrays entrepreneurial opportunities as pre-existing entities waiting to be discovered by vigilant entrepreneurs. This perspective perceives opportunities as objects in the external environment, observable and waiting for recognition [14].

In contrast, the "creation approach," the second conceptual definition of opportunity, contends that opportunities are not external entities but internally generated through entrepreneurial actions [15]. This view posits that opportunities are not separate from the individuals who conceive them, as they emerge from the entrepreneurial process through interactive actions and changes involving the entrepreneur, relevant stakeholders, and their immediate environment [16]. Consequently, the development of an entrepreneurial path is contingent upon improvisation, learning, and the passage of time, with a focus on the agency of the entrepreneur. Opportunity emergence results from entrepreneurial actions, specifically through observation followed by action. The progression of this pathway is probabilistic and dependent on the actions taken by the entrepreneur, which in turn influence the course of events. The path does not manifest until the entrepreneur acts upon it or decides to do so.

Ramoglou and Tsang [3] introduced the concept of opportunities as unactualized propensities, suggesting that opportunities may remain unrealized because certain powers are not triggered, or if triggered, they may not become evident due to constraining factors or the absence of enabling factors. This idea introduces the notion of actualization, where opportunities are characterized by latent potential waiting to be realized. This concept draws an analogy to a seed with the propensity to transform into a flower [3]. However, the actualization of this potential is contingent on a nurturing environment and external facilitators while also being susceptible to risks such as adverse weather or predation.

In essence, opportunities as propensities are constrained by the environmental context and influenced by factors such as risk and uncertainty [17]. Despite the long history of acknowledging Knightian uncertainty as a precursor to profit-making, the precise identification, description, and operationalization of uncertainty remain challenging, often exhibiting conflicting definitions and

measures [11]. Shane and Venkataraman's [14] framework raises a fundamental and crucial question: why do entrepreneurial opportunities exist and why do some individuals discover and capitalize on these opportunities while others do not?

### 2.1. Critiques of opportunity as an effective construct

The existing critiques surrounding the conceptualization of entrepreneurial opportunity fail to address a fundamental question: why do certain individuals discover and exploit opportunities while others do not? Alvarez and Barney [18, 19] criticized the Shanian discovery approach, deeming it tautological and empirically intractable. This perspective poses challenges because entrepreneurs typically lack ex-ante knowledge of the outcome of their ventures. Moreover, it conflates agency and structure, complicating the differentiation between the two [20]. Determining whether an opportunity is genuine becomes problematic since only successful outcomes are considered evidence of the prior existence of objectively independent opportunities. Thus, establishing the existence of an opportunity is complex and contingent on various factors. The realization of a profitable venture depends on intricate, empirically unobservable generative mechanisms [4].

Time plays a pivotal role in understanding opportunity, both ontologically and epistemologically. When should an opportunity be recognized as such? Is it when its profits are realized or when a venture proves profitable? Or does it precede these outcomes? If an opportunity leads to business failure due to execution issues, does it still qualify as an opportunity (i.e., is it a true positive)?

Conversely, if the initial opportunity belief is a false positive, can it still be considered an opportunity despite the wasted resources and effort [5]? The Alvarez-Bamean creation view, derived from Schumpeter's [21] perspective, portrays entrepreneurs as initiators of change and active creators of new resource combinations. This view suggests entrepreneurs subjectively imagine and act upon opportunities through interactions with stakeholders and the environment. According to this view, opportunities are by-products of entrepreneurial actions and lack prior independent existence. They are seen as works-in-progress, unfolding nonlinearly as entrepreneurial ideas are refined, relationships with stakeholders evolve, and resources are acquired, combined, recombined, and finally mobilized toward a desired end [20, 22]. However, this perspective introduces an imprecise notion of opportunity, as it portrays opportunity as something that is shaped (unfolding) into existence rather than inherently existing.

A more recent development is Ramoglou and Tsang's [3] actualization view, which regards opportunities as carrying potential with a propensity for actualization. This suggests that opportunities exist independently but cannot be measured when initially perceived. Instead, they are latent market demands accessible through an entrepreneur's imagination or belief [3]. However, this view has been critiqued for its metatheoretical and practical shortcomings, as it relies heavily on unobservable generative mechanisms that hinder empirical research [4].

Foss et al. [23] argued that the opportunity construct has led to a stalemate in entrepreneurship research and fails to adequately address uncertainty, a core element in entrepreneurship. They propose an alternative approach based on entrepreneurial judgment, emphasizing resource heterogeneity and uncertainty within the beliefs-actions-results (BAR) framework. Kitching and Rouse [20] also critiqued

the dominant discovery and creation approaches, finding them conceptually confusing. They propose a new analytical framework inspired by critical realism, focusing on entrepreneurial action and the structural and cultural conditions shaping it.

While the definitional challenges surrounding opportunity are acknowledged, they hold representational value. Various suggestions, such as focusing on external enablement, venture ideas, opportunity confidence, or entrepreneurial judgment, still do not fully explain what motivates entrepreneurs to take action. This thesis proposes re-contextualization of the opportunity construct as an artifact with potentialities and probabilistic emergence [2] to elucidate the forces driving entrepreneurial action.

A larger question arises: is the observable opportunity real or artificial? The misuse of realism in exploring entrepreneurial opportunities has been highlighted by Ramoglou [24]. This raises questions about whether opportunities exist within or outside the mind as objectively observable holograms [25]. Agential beliefs, imagined futures, or imagined opportunities are mental constructs within the minds of entrepreneurs and are thus subject to individual cognitive characteristics and information-processing capabilities [26]. The cognitive limitations on human rationality lead to the creation of artifacts that achieve local optima at best. These artifacts adapt to contingencies over time, sometimes exploiting them for survival and prosperity [27]. Therefore, the extent and scale of the imagined opportunity-as-artifact are constrained by the observer's cognitive limitations and ability to learn and adapt to prevailing conditions and resources for survival and prosperity.

### 3. Discussion

Everett [1] asserted that the universe operates entirely within the framework of quantum mechanics. He contended that the rules governing the behavior of atoms and subatomic particles at the quantum level apply universally, even to macroscopic objects and everyday phenomena. Everett is best known as the originator of the Many-Worlds interpretation of quantum mechanics, a theory that has garnered significant attention for its controversial and counterintuitive implications. This interpretation was developed as a response to the long-standing challenge of indeterminism in quantum physics, offering a universe where all possible outcomes exist with a probabilistic chance of occurrence.

Everett's [1] Many-Worlds interpretation, also called the relative state formulation, was first introduced in 1957. DeWitt [10] later popularized and coined the term "Many-worlds interpretation." According to this interpretation, the universal wave function is objectively real [28]. It posits that all potential probabilistic outcomes from quantum observations and measurements are actualized in parallel universes. The act of observation by an observer's consciousness triggers the selection of a specific outcome and subsequent actions. As DeWitt [10] described, the result of a quantum measurement is a superposition of vectors, each representing one of the possible values of the observed quantity. The challenge lies in reconciling this superposition with the fact that, in practice, only one value is observed. The observer, equipped with prior knowledge, experience, and new information, along with entanglement effects, causes a rapid and non-linear transition to a state where the measured property either determinately exists or does not. In other words, the moment of observation and the subsequent decision to act leads to the emergence of a specific reality [2].

Superposition is a fundamental quantum state in which a quantum system simultaneously exists in multiple states until it is observed and measured [29]. This concept aligns with the idea that actualities are selected from broader possibilities. As James [30] noted, “Actualities seem to float in a wider sea of possibilities from out of which they were chosen, and somewhere, indeterminism says, such possibilities exist, and form part of the truth.” In essence, Everett’s [1] key postulations can be summarized as follows [31]: (1) all isolated systems evolve according to the Schrödinger equation, which describes the wavefunction of quantum mechanical systems; (2) quantum measurements do not yield definite outcomes; instead, they result in multiple parallel universes or worlds, and the collapse of the wavefunction is considered a violation of Everett’s postulations.

Schrödinger [32] famously critiqued the notion of a quantum superposition collapsing upon observation, finding it absurd that the wavefunction could be governed by two fundamentally different processes: the Schrödinger wave equation and the direct interference of the observer, which is not controlled by the same wave equation. Schrödinger [32] found it implausible that unobserved nature would behave one way according to the wave equation but rapidly devolve into chaos upon observation.

The Many-Worlds interpretation, developed by Everett and further refined by DeWitt’s [10] parallel worlds model, addresses this conundrum. Aligned with the concept of wave-particle duality, it is postulated that these potentialities exist in a specific state prior to being observed, analogous to entrepreneurial opportunities in their latent or potential state. When subjected to observation, they experience a transition, collapsing into a definite state [33]. This phenomenon is particularly relevant when considering isolated systems, where the evolution of these potentialities follows the fundamental principles outlined in the Schrödinger equation. The Schrödinger equation governs the

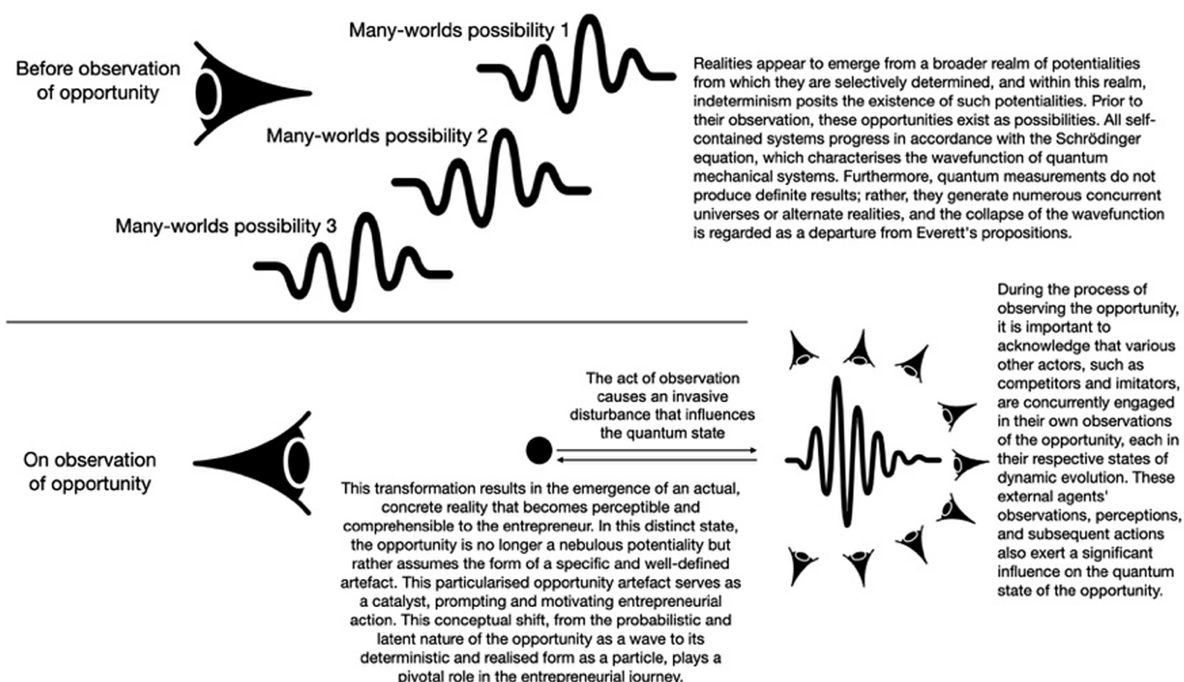
wavefunction of quantum mechanical systems and provides a mathematical description of their behavior.

During the observation process, the wave associated with an entrepreneurial opportunity undergoes a transition, collapsing into a particle-like state. (Figure 1 illustrates the wave-particle duality phenomenon). This transformation results in the emergence of an actual, concrete reality that becomes perceptible and understandable to the entrepreneur. In this distinct state, the opportunity is no longer a nebulous potentiality but instead assumes the form of a specific and well-defined artifact. This particularized opportunity artifact serves as a catalyst, prompting and motivating entrepreneurial action. This conceptual shift plays a pivotal role in the entrepreneurial journey, from the probabilistic and latent nature of the opportunity as a wave to its deterministic and realized form as a particle. It marks the juncture at which the entrepreneur understands the opportunity and can engage with it purposefully [34].

While observing the opportunity, it is essential to acknowledge that various other actors, such as competitors and imitators, are concurrently engaged in their observations of the opportunity, each in their respective states of dynamic evolution. These external agents’ observations, perceptions, and subsequent actions also significantly influence the quantum state of the opportunity.

In this complex entrepreneurial ecosystem, observation extends beyond the entrepreneur alone. Competitors and imitators actively monitor and assess the opportunity landscape, and their perceptions and decisions are intertwined with the opportunity’s quantum dynamics. As these external entities make their observations and take corresponding actions, they contribute to the continuous evolution of the opportunity’s quantum state. This multifaceted interaction among entrepreneurial agents leads to a dynamic and ever-changing landscape where the quantum properties of the opportunity are subject to constant fluctuations and adjustments. Consequently, the quantum nature of the

Figure 1  
Wave-particle duality and interference of other observers





opportunity is not solely shaped by the entrepreneur's actions but is also influenced by the responses and behaviors of these external actors within the entrepreneurial environment. This dynamic interplay underscores the intricate and interconnected nature of opportunities in the entrepreneurial realm, where the quantum state is a product of collective observations and actions.

The collapse of the opportunity wave into a particle state signifies the transition from uncertainty and potentiality to a tangible and actionable reality, influencing the entrepreneur's decision-making and guiding their entrepreneurial actions.

Also, Schrödinger's famous cat thought experiment provides a clear resolution in a separate interpretation. In the Many-Worlds framework, one cat is alive in one world, while another is dead in another. The act of opening the box and observing the cat's state leads to the actualization of one of these parallel universes, resolving the uncertainty.

In summary, the Many-Worlds interpretation proposed by Everett challenges conventional quantum physics by suggesting that the wavefunction does not collapse upon observation but instead represents multiple simultaneous possibilities. These possibilities exist as parallel universes or worlds, only becoming determinate when observed. This interpretation provides a unique perspective on the fundamental principles of quantum mechanics and the nature of reality.

### 3.1. Quantum's indeterminacy

Quantum physics is a domain that deals primarily with probabilities and indeterminacy rather than certainties and determinacy. Central to this field is Schrödinger's wave function, which encapsulates all conceivable outcomes in a superposition state until the moment of observation and measurement. At that precise instant, only one actuality emerges, giving rise to a singular reality based on the observation-action taken. This fundamental principle is illustrated by Schrödinger's [32] famous thought experiment involving a cat, a paradoxical example of quantum superposition.

In Schrödinger's cat thought experiment, an imaginary cat is placed in a superposition state, where it can simultaneously exist as both alive and dead. This dual state is contingent upon a specific event, the decay of a single atom, which is linked to the cat's fate. The cat is enclosed in a sealed box with a vial of poison and a radioactive source. A Geiger counter is employed to monitor radioactivity, and radiation detection triggers the shattering of the poison vial, leading to the cat's demise. In the absence of observation, the cat remains in a superposition state, existing as both alive and dead, as the observer possesses no prior knowledge of whether the poison has been released. This uncertainty parallels the challenges entrepreneurs face who lack comprehensive information and foresight regarding potential outcomes. Only when observed does the cat appear alive or dead, but not simultaneously. The transition from superposition to a definite state upon observation is a source of bewilderment for observers, much like the uncertainty experienced by entrepreneurs in situations with limited information and knowledge.

This paradoxical nature of superposition is not limited to Schrödinger's cat experiment but extends to various decision points entrepreneurs encounter. Entrepreneurs must navigate through these forked junctures, each laden with probabilistic outcomes and hidden variables representing uncertainty [35].

This paper contends that the opportunity artifact can be likened to a sealed box containing hidden variables and numerous potential outcomes akin to the many worlds of quantum physics. The

conventional explanation for the emergence of reality hinges on the concept of wavefunction collapse, wherein all other possibilities collapse to give rise to a singular emergent reality. In contrast, the Many-Worlds interpretation asserts that the universal wave function is objectively real and negates the need for wave function collapse [28]. Instead, it posits that the wave function splits into multiple branches, each corresponding to different potential observation and measurement outcomes.

### 3.2. Heisenberg's acorn and Ramoglou and Tsang's seed

The perennial epistemological inquiries concerning the nature of knowledge in creating, discovering, or actualizing opportunities ought to be approached with a pragmatic perspective [36]. The ongoing discourse on opportunities, aimed at challenging and redefining the concept of opportunity, is essentially centered around inconsequential epistemological debates. These debates necessitate establishing an overarching framework that accommodates the various interpretations of opportunities.

Davidsson [37] recommended that entrepreneurship researchers avoid conceptually dividing complex and empirically non-tractable external circumstances into binary categories of "opportunities" versus "non-opportunities." Instead, the focus should shift toward recognizing the multidimensional and continuous variations in the entities that entrepreneurs genuinely assess and, at times, act upon. These entities should not be mislabeled as "opportunities." Davidsson [37] proposed "agency intensity" as a more fitting label than the opportunity construct, positioning it as a central concept in entrepreneurship.

The Many-Worlds interpretation of opportunities incorporates the concept of agency intensity, with the entrepreneur serving as the central figure. In this context, the observer assumes critical importance as opportunities derive their forms and characteristics from the interpretations made by the observer. The interaction between the observer and the observed object (opportunity) engenders uncontrollable and indeterministic transformations.

Ramoglou and Tsang [3] sought to "ontologically rehabilitate the objectivity of entrepreneurial opportunities by elucidating their propensity mode of existence." They defined "opportunity as the propensity of market demand to be actualized into profits through the introduction of novel products or services." Ramoglou and Tsang's [3] propensity framework for opportunities closely connects to the Many-Worlds model in entrepreneurial opportunities. Just as Many-World possibilities are characterized by the wavefunction described by Schrödinger's wave equation, it is plausible to view the opportunity's wavefunction as a tangible entity containing a range of potential outcomes. Each of these outcomes carries the potential to materialize based on the observer's actions.

This paper suggests that superposition, as applied to opportunity constructs, holds all these propensities in abeyance until observation and action come into play. This perspective aligns with Kirzner's [38] view that objective opportunities are, in principle, observable. However, Alvarez and Barney [18] argued that opportunities are essentially "social constructions that do not exist independent of entrepreneurs' perceptions." They maintain that when entrepreneurs act to exploit these socially constructed opportunities, they interact with a market environment that tests the validity of their perceptions. The market itself is a social construct shaped by the beliefs and perceptions of numerous individuals.

From a creation perspective, as entrepreneurs embark on actions based on their beliefs (the mental projection of the vague form of the

opportunity), the opportunity begins to take shape [26]. Variations arise, prompting the entrepreneur to respond with further social construction. These variational responses are part of the social construction that guides subsequent actions. As entrepreneurs act on their initial beliefs about opportunities and respond to market feedback, their beliefs transform the acquisition and creation of knowledge and information [39]. This process of acquiring and creating knowledge and information self-organizes the entrepreneur, leading to the development of new beliefs. With iterative actions, evaluations, and reactions to the presentation of opportunities (each carrying implied Many-World possibilities), the entrepreneur enters one of the many worlds, each characterized by its inherent potential to materialize into a specific reality.

While potentialities are not directly observable, they are embedded in certain opportunity beliefs, and the strength of these beliefs, along with intentionality, spurs entrepreneurial actions. It is essential to recognize that potentialities or propensities cannot initiate action on their own; they must be brought to the forefront and acted upon by the observer, who is typically the entrepreneur. In entrepreneurship, action plays a pivotal role, and entrepreneurial endeavors are predicated on action [40].

This paper advances the Many-Worlds approach by addressing crucial aspects such as the potentialities or propensities of opportunities, the role of agentic effort, and the observer effect in actualizing opportunities. Heisenberg's proposal to rethink the nature of reality, which hinges on the concept of potentiality, is pertinent to this discussion. This concept involves the realization of a quantum potentiality, symbolized by the wave function, into actuality. The nature of the quantum entity does not solely determine the process of actualization but is also influenced by the apparatus and the entire experimental setup [41]. In this context, the setup and the observation apparatus correspond to how entrepreneurs arrange their entrepreneurial activities to pursue opportunities. The act of observation and subsequent action guide the emerging potentiality into a tangible form, eventually culminating in actuality. Ramoglou and Tsang [3] likened opportunities to seeds with latent potential and the capacity to germinate into a flower, emphasizing the unobservable latency and potency that define opportunities.

In conclusion, the fundamental nature of the seed in opportunity, which must exist before actualizing profit goals, is characterized by its latent potentialities and propensities. These potentialities, suspended in a state of superposition until observed and acted upon, undergo a transformation guided by entrepreneurial actions and knowledge acquisition. This transformation culminates in the emergence of a specific reality from a range of potential outcomes akin to actualizing a quantum potentiality.

### 3.3. Overcoming opportunity's elusiveness and definitional clumsiness

Entrepreneurial opportunity serves as the catalyst that propels entrepreneurs into action. This paper posits that opportunities are mental constructs within an entrepreneur's mind, either visualized mentally [26] or presented in a holographic manner [25]. Suddaby et al. [42] highlighted two recurring themes central to the fundamental question of the origin and emergence of opportunities. First, they identify imprinting and reflexivity as pivotal mechanisms and core concepts that underlie the broader debate surrounding whether entrepreneurs discover or create opportunities. Theoretical perspectives advocating a discovery paradigm view imprinting as a crucial process explaining how certain entrepreneurs are more inclined to discover opportunities.

Conversely, theories emphasizing a creation perspective regard reflexivity as a core concept, elucidating how some actors excel in creating entrepreneurial opportunities [42].

Imprinting, influenced by social and historical contexts encompassing prior knowledge, experiences, exposure to social networks (such as family and friends), and new contextual information from the external environment, leaves an indelible mark on entrepreneurs. Upon observing an opportunity, the act of observation exerts an imprinting effect, narrowing the range of potentialities within the opportunity. Employing the Many-Worlds model, entrepreneurs generate permutations of possibilities rooted in their level of imprinting and ultimately decide to take action. It is imperative to distinguish that the propensities of an opportunity differ from the permutations of possibilities in the minds of entrepreneurs. Due to uncertainty and the unknown, entrepreneurs grapple with making sense of their actions based on existing knowledge and information, lacking foreknowledge.

Consequently, ex-ante knowledge of the outcomes of their actions remains elusive. Foss et al. [23] adopted a judgment-based approach, asserting that opportunities lack objective existence because the consequences of actions cannot be definitively known ex-ante when decisions to act on opportunities are made. Entrepreneurs act based on their envisioned opportunity beliefs, and the subsequent actions following their decisions produce specific outcomes or actualities. The actualization of potentiality aligns with Schrödinger's wave function. In light of this, Foss et al. [23] concluded that opportunities are fundamentally subjective phenomena, stating that opportunities are "either discovered or created but imagined." This paper adopts a more comprehensive perspective, informed by the Many-Worlds model, where opportunities can simultaneously be discovered, created, actualized, or imagined.

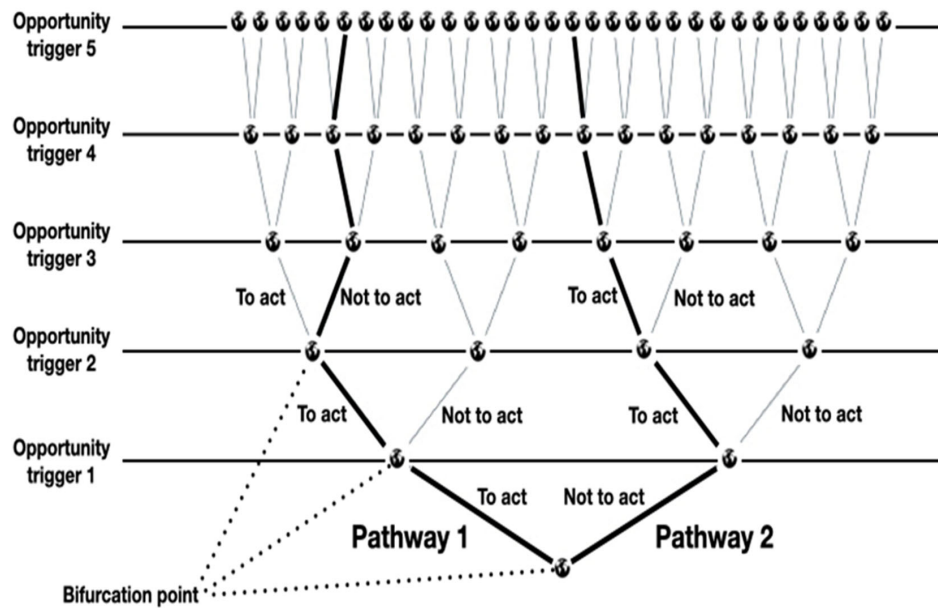
Entrepreneurs engage in imaginative and imprinting processes, envisioning various possibilities based on their prior knowledge and the information available at the moment of decision and action. They mentally visualize opportunities and constraints while engaged in this imaginative process [26]. Entrepreneurs adeptly combine and recombine available resources, guided by reflexivity, to serve novel purposes [43].

The Many-Worlds interpretations have faced numerous criticisms. However, this paper incorporates relevant concepts and re-contextualizes them to elucidate entrepreneurial phenomena, particularly the uncertainties and probabilistic emergences inherent in entrepreneurial ventures.

### 3.4. The Many-Worlds interpretation of opportunity as an artifact

The Many-Worlds interpretation within the realm of quantum physics presents an intriguing and highly counterintuitive proposition. It suggests the existence of numerous potential worlds, each characterized by its own set of non-deterministic events. At every juncture or bifurcation point, the universe branches into multiple options, giving rise to different possibilities. As depicted in Figure 2, each world leads to a distinct emergence. In a study conducted by Kearney and Lichtenstein [44], 20 founders/CEOs of high-potential ventures in Ireland were interviewed to gain insights into the dynamics of emergent change throughout the entrepreneurial journey. Their findings revealed a set of process dynamics encompassing aspects such as instability, tension, non-linear transformation, unpredictability, and surprise. Additionally, the study highlighted the outcome dynamics characterized by creating new knowledge, enhanced capabilities, and developing emergent

Figure 2  
Many-Worlds interpretation of opportunity as an artifact with quantum property



structures. These dynamics were pervasive across various facets of entrepreneurship [44].

The entrepreneurial process is renowned for its complexity and multifaceted nature [45]. It involves numerous opportunity triggers, each potentially leading to diverse outcomes, ranging from success to failure. Davidsson and Gruenhagen [45] argued that existing research has paid insufficient attention to factors such as transition frequency and magnitude, breadth (i.e., the number of parallel activities), flexibility (the degree of freedom associated with pursuing each activity independently), and complexity (involving a multitude of activities and actors with causal interrelations and interdependence). They further emphasized the lack of understanding regarding the antecedents, their effects, variations, and prevalence within this context. This paper introduces the Many-Worlds model to provide a framework for comprehending and elucidating the concepts of transition, breadth, flexibility, and complexity. Within the Many-Worlds interpretation, the branching outcomes at critical junctures account for transition, breadth, flexibility, and complexity, offering a coherent explanatory framework.

The holistic approach adopted by the Many-Worlds model explores how entrepreneurial opportunity, conceptualized as an artifact, embodies a multitude of potentialities contingent upon the subjective observations and mental frameworks of individual entrepreneurs. Throughout the entrepreneurial journey, entrepreneurs encounter phenomena like instability, tension, unpredictability, and surprise [44]. They must make judgment calls at each juncture regarding whether to take action or not. Subjectivism is pivotal as each entrepreneur possesses distinct knowledge, preferences, and expectations [23]. This subjectivity influences every unique observation, with the observer's mental visualization and perceptual lens giving rise to different perceived realities. In this context, the reality within each world gains meaning only through the interaction and interpretation of each entrepreneur, who serves as an observer. The process dynamics experienced by entrepreneurs, characterized by instability, tension, non-linear change, unpredictability, and surprise, are intertwined with the macroeconomic context in which entrepreneurs operate, resulting in an imprinted reality.

This interplay between observation and action echoes the notion that “the very act of observation is to be considered as an integral part of the observed system” [46]. For instance, in the Schrödinger cat experiment, the absence of observation renders it impossible to determine whether a specific atom has decayed. In the absence of observation, a superposition of states is maintained, represented by Schrödinger’s wavefunction, where the atom simultaneously exists in both a decayed and non-decayed state or where the cat is simultaneously dead and alive. Everett’s postulate posits that all isolated systems evolve following Schrödinger’s equation, implying that the entire universe, functioning as a single isolated system, encompasses all possible propensities within a superposition of multiple states. Entrepreneurial emergence inherently involves the processes of observation and action. Entrepreneurial action is behavior stemming from judgmental decisions made under conditions of uncertainty regarding potential profit opportunities [40]. When viewed within the framework of human action, entrepreneurial decisions essentially entail deciding whether to act at each bifurcation point, as illustrated in Figure 2.

In its present state, this Many-Worlds model is a conceptual framework for understanding the probabilistic emergence within entrepreneurship. Each entrepreneurial opportunity, conceived as an artifact, encapsulates various potentialities and propensities for actualization, contingent upon subjective entrepreneurial observations, discoveries, judgments, and interpretations.

#### 4. Conclusion

Observing an entrepreneurial opportunity, coupled with interpreting such observations within the intricate web of reality, holds immense significance for practitioners in the field. Within this framework, generating potential universes and diverse entrepreneurial pathways becomes consequential. By drawing parallels with the probabilistic enigmas of quantum mechanics, as exemplified by the Many-Worlds model, entrepreneurs gain a deeper understanding of their experiences and encounters, including those that may appear random and arbitrary.

The probabilistic emergence encapsulated in the Many-Worlds opportunity construct finds resonance in Schrödinger's wavefunction. When observing an opportunity, the wave function, which initially describes the superposition of all conceivable possibilities, undergoes evolution, introducing elements of discontinuity and uncertainty. Ultimately, a singular observation outcome emerges, with only one reality persisting throughout the process, effectively dismissing all other possibilities from the realm of classically described reality. This emergent possibility occurs in the information-rich wave function preceding any decisive action. Entrepreneurs, in their pursuit of informed judgments, rely on this information, and their subsequent actions steer the course toward a particular outcome amidst a backdrop of numerous potentialities.

In light of the emphasis on agency-centricity, it is evident that entrepreneurs' observations and discovery of opportunities unveil latent potencies and propensities. However, their affirmative entrepreneurial actions can fundamentally reshape the trajectory of entrepreneurial ventures, often amidst the backdrop of inherent unpredictability. While Einstein famously asserted that "God does not play with dice," entrepreneurs navigate uncertainty and unknowingness, making calculated decisions and forging their paths in a dynamic landscape.

This discourse underscores the intricate interplay between the conceptualization of entrepreneurial opportunities, their practical implications, and the inherent probabilistic nature of entrepreneurial pursuits. The Many-Worlds model provides a valuable framework for understanding the complex and often uncertain terrain in which entrepreneurs operate, shedding light on the multifaceted dynamics that shape their endeavors. As entrepreneurs grapple with the intricate dance between observation, action, and outcome, the probabilistic nature of their reality remains an ever-present and indispensable facet of their entrepreneurial journey.

## 5. Limitations

This discussion is grounded in the conceptual framework of the Many-Worlds interpretation, which is metaphorically and analogically applied to clarify various entrepreneurial phenomena. It is important to note that such theorization lacks empirical verifiability due to the inherent nature of the theory, as it pertains to the existence of multiple worlds and possibilities within the vast branches of potentialities.

The fundamental premise of the Many-Worlds theory posits the existence of a single wave function encompassing the entire universe. However, this wave function remains unobservable, and predictions derived from it are inherently probabilistic, giving rise to the enigma surrounding the collapse of the wave function [47]. Carroll [48] even suggested that the many different worlds exist parallel to our own and are so hidden that ghosts might as well populate them.

One limitation of this theorization is its inherent inability to undergo empirical validation, as it posits the existence of multiple worlds with numerous replicas of realities. It operates on a one-observer-in-one-world basis, with no means of cross-validation between these worlds. The relationship between the experienced world and its experiencer is unique. This paper acknowledges that this theorization faces limitations in empirical validation, given its foundational premise of one experiencer in an experienced world. By considering a range of possibilities beyond the confines of a single observable world, this theory enables us to develop broader and more nuanced hypotheses that, while inspired by the concept of multiple worlds, are grounded in and adaptable to the empirical realities of our singular world. Even Schrödinger's famed thought experiment involving the state of a cat as dead or alive

demonstrates this concept, where each cat exists in separate existential worlds within individual boxes. This conceptualization is part of the ongoing discourse within the field of quantum mechanics, with each interpretation, including the Many-Worlds interpretation, having its merits and criticisms.

Diverging from Ramoglou and Tsang's [3] analogy of a seed or Heisenberg's acorn, the Many-Worlds model of opportunity encompasses a multitude of propensities and potentialities, each capable of manifesting different outcomes contingent upon environmental contexts and entrepreneurial actions. This model provides entrepreneurship research with a means to comprehend the emergence of probabilities and potentialities within opportunities. It accommodates various perspectives in the ongoing "opportunity war" [36, 49, 50], including the notions of discovery, creation, and actualization, without conflicting with the diverse arguments within this discourse. As Ramoglou and Tsang [3] aptly noted, entrepreneurial discourse navigates complex intellectual terrain, delving into the metaphysics of potentiality and the nature of human intentionality.

## Ethical Statement

This study does not contain any studies with human or animal subjects performed by the author.

## Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

## Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## References

- [1] Everett, H. (2012). *The Everett interpretation of quantum mechanics: Collected works 1955–1980 with commentary*. USA: Princeton University Press.
- [2] Leong, D. (2022). Probabilistic interpretation of observer effect on entrepreneurial opportunity. *Organizacija*, 55(4), 243–258. <https://doi.org/10.2478/orga-2022-0016>
- [3] Ramoglou, S., & Tsang, E. W. K. (2015). A realist perspective of entrepreneurship: Opportunities as propensities. *Academy of Management Review*, 41(3), 410–434. <https://doi.org/10.5465/amr.2014.0281>
- [4] Berglund, H., & Korsgaard, S. (2017). Opportunities, time, and mechanisms in entrepreneurship: On the practical irrelevance of propensities. *Academy of Management Review*, 42(4), 730–733. <https://doi.org/10.5465/amr.2016.0168>
- [5] Leong, D. (2021). Re-contextualizing opportunity as artifact signalling for entrepreneurial action. *Journal of Developmental Entrepreneurship*, 26(3), 2150021. <https://doi.org/10.1142/S1084946721500217>
- [6] Bhaskar, R. (2013). *A realist theory of science*. UK: Taylor & Francis.
- [7] Baclawski, K. (2018). The observer effect. In *IEEE Conference on Cognitive and Computational Aspects of Situation Management*, 83–89. <https://doi.org/10.1109/COGSIMA.2018.8423983>
- [8] Thompson, W. C. (2016). Observer effects. In A. Jamieson & S. Bader (Eds.), *A guide to forensic DNA profiling* (pp. 171–174). Wiley.



- [9] Stapp, H. P. (1972). The Copenhagen interpretation. *American Journal of Physics*, 40(8), 1098–1116. <https://doi.org/10.1119/1.1986768>
- [10] DeWitt, B. S. (1970). Quantum mechanics and reality. *PHYSICS TODAY*, 23(9), 30–35. <https://doi.org/10.1063/1.3022331>
- [11] Townsend, D. M., Hunt, R. A., McMullen, J. S., & Sarasvathy, S. D. (2018). Uncertainty, knowledge problems, and entrepreneurial action. *Academy of Management Annals*, 12(2), 659–687. <https://doi.org/10.5465/annals.2016.0109>
- [12] Sen, D. (2014). The uncertainty relations in quantum mechanics. *Current Science*, 107(2), 203–218.
- [13] Ramoglou, S., & Tsang, E. W. K. (2017). In defense of common sense in entrepreneurship theory: Beyond philosophical extremities and linguistic abuses. *Academy of Management Review*, 42(4), 736–744. <https://doi.org/10.5465/amr.2017.0169>
- [14] Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), 217–226. <https://doi.org/10.2307/259271>
- [15] Sarasvathy, S. D. (2001). Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26(2), 243–263. <https://doi.org/10.5465/amr.2001.4378020>
- [16] Alvarez, S. A., Barney, J. B., McBride, R., & Wuebker, R. (2014). Realism in the study of entrepreneurship. *Academy of Management Review*, 39(2), 227–233. <https://doi.org/10.5465/amr.2013.0244>
- [17] Jones, R. J., & Barnir, A. (2019). Properties of opportunity creation and discovery: Comparing variation in contexts of innovativeness. *Technovation*, 79, 1–10. <https://doi.org/10.1016/j.technovation.2018.02.014>
- [18] Alvarez, S. A., & Barney, J. B. (2007). Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 1(1–2), 11–26. <https://doi.org/10.1002/sej.4>
- [19] Alvarez, S., & Barney, J. B. (2020). Has the concept of opportunities been fruitful in the field of entrepreneurship? *Academy of Management Perspectives*, 34(3), 300–310. <https://doi.org/10.5465/amp.2018.0014>
- [20] Kitching, J., & Rouse, J. (2017). Opportunity or dead end? Rethinking the study of entrepreneurial action without a concept of opportunity. *International Small Business Journal*, 35(5), 558–577. <https://doi.org/10.1177/0266242616652211>
- [21] Schumpeter, J. A. (1983). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. USA: Transaction Books.
- [22] Dimov, D. (2011). Grappling with the unbearable elusiveness of entrepreneurial opportunities. *Entrepreneurship Theory and Practice*, 35(1), 57–81. <https://doi.org/10.1111/j.1540-6520.2010.00423.x>
- [23] Foss, N. J., Klein, P. G., Kor, Y. Y., & Mahoney, J. T. (2008). Entrepreneurship, subjectivism, and the resource-based view: Toward a new synthesis. *Strategic Entrepreneurship Journal*, 2(1), 73–94. <https://doi.org/10.1002/sej.41>
- [24] Ramoglou, S. (2013). On the misuse of realism in the study of entrepreneurship. *Academy of Management Review*, 38(3), 463–465. <https://doi.org/10.5465/amr.2012.0371>
- [25] Leong, D. (2023). Opportunity-as-hologram: Real or artificial in entrepreneurship. *Asian Academy of Management Journal*, 28(2), 421–448. <https://doi.org/10.21315/aamj2023.28.2.14>
- [26] Leong, D. (2023). Mental modeling of entrepreneurial opportunity based on the principle of information visualization. *Business Perspectives and Research*, 22785337221148302. <https://doi.org/10.1177/22785337221148302>
- [27] Sarasvathy, S. D. (2003). Entrepreneurship as a science of the artificial. *Journal of Economic Psychology*, 24(2), 203–220. [https://doi.org/10.1016/S0167-4870\(02\)00203-9](https://doi.org/10.1016/S0167-4870(02)00203-9)
- [28] DeWitt, B. S., & Graham, N. (2015). *The many-worlds interpretation of quantum mechanics*. USA: Princeton University Press.
- [29] Gerry, C. C., & Knight, P. L. (1997). Quantum superpositions and Schrödinger cat states in quantum optics. *American Journal of Physics*, 65(10), 964–974. <https://doi.org/10.1119/1.18698>
- [30] James, W. (2010). *The dilemma of determinism*. USA: Kessinger Publishing.
- [31] Tegmark, M. (1998). The interpretation of quantum mechanics: Many worlds or many words? *Progress of Physics*, 46(6–8), 855–862. [https://doi.org/10.1002/\(SICI\)1521-3978\(199811\)46:6%3C855::AID-PROP855%3E3.0.CO;2-Q](https://doi.org/10.1002/(SICI)1521-3978(199811)46:6%3C855::AID-PROP855%3E3.0.CO;2-Q)
- [32] Schrödinger, E. (1995). *The interpretation of quantum mechanics: Dublin seminars (1949–1955) and other unpublished essays*. USA: Ox Bow Press.
- [33] Pospiech, G. (2000). Uncertainty and complementarity: The heart of quantum physics. *Physics Education*, 35(6), 393. <https://doi.org/10.1088/0031-9120/35/6/303>
- [34] Shane, S., & Eckhardt, J. (2003). The individual–opportunity nexus. In Z. J. Acs & D. B. Audretsch (Eds.), *Handbook of entrepreneurship research* (pp. 161–191). Springer. [https://doi.org/10.1007/0-387-24519-7\\_8](https://doi.org/10.1007/0-387-24519-7_8)
- [35] Lainé, M. (2021). Opening the black box of investment expectations: An empirical inquiry into animal spirits. *Journal of Post Keynesian Economics*, 44(3), 411–433. <https://doi.org/10.1080/01603477.2020.1852091>
- [36] Ramoglou, S., & Gartner, W. B. (2023). A historical intervention in the “opportunity wars”: Forgotten scholarship, the discovery/creation disruption, and moving forward by looking backward. *Entrepreneurship Theory and Practice*, 47(4), 1521–1538. <https://doi.org/10.1177/10422587211069310>
- [37] Davidsson, P. (2017). Entrepreneurial opportunities as propensities: Do Ramoglou & Tsang move the field forward? *Journal of Business Venturing Insights*, 7, 82–85. <https://doi.org/10.1016/j.jbvi.2016.02.002>
- [38] Kirzner, I. M. (1979). *Perception, opportunity, and profit: Studies in the theory of entrepreneurship*. USA: University of Chicago Press.
- [39] Arrow, K. J. (1974). *The limits of organisation*. USA: W. W. Norton & Company.
- [40] McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1), 132–152. <https://doi.org/10.5465/AMR.2006.19379628>
- [41] Kožnjak, B. (2020). Aristotle and quantum mechanics: Potentiality and actuality, spontaneous events and final causes. *Journal for General Philosophy of Science*, 51(3), 459–480. <https://doi.org/10.1007/s10838-020-09500-y>
- [42] Suddaby, R., Bruton, G. D., & Si, S. X. (2015). Entrepreneurship through a qualitative lens: Insights on the construction and/or discovery of entrepreneurial opportunity. *Journal of Business Venturing*, 30(1), 1–10. <https://doi.org/10.1016/j.jbusvent.2014.09.003>
- [43] Baker, T., & Nelson, R. E. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, 50(3), 329–366. <https://doi.org/10.2189/asqu.2005.50.3.329>

- [44] Kearney, C., & Lichtenstein, B. (2023). Generative emergence: Exploring the dynamics of innovation and change in high-potential start-up ventures. *British Journal of Management*, 34(2), 898–914. <https://doi.org/10.1111/1467-8551.12604>
- [45] Davidsson, P., & Gruenhagen, J. H. (2021). Fulfilling the process promise: A review and agenda for new venture creation process research. *Entrepreneurship Theory and Practice*, 45(5), 1083–1118. <https://doi.org/10.1177/1042258720930991>
- [46] Karsten, S. G. (1990). Quantum theory and social economics: The holistic approach of modern physics serves better than Newton's mechanics in approaching reality. *The American Journal of Economics and Sociology*, 49(4), 385–399. <https://doi.org/10.1111/j.1536-7150.1990.tb02461.x>
- [47] Crease, R. P. (2019). The bizarre logic of the many-worlds theory. *Nature*, 573, 30–32. <https://doi.org/10.1038/d41586-019-02602-8>
- [48] Carroll, S. (2020). *Something deeply hidden: Quantum worlds and the emergence of spacetime*. UK: Penguin Publishing Group.
- [49] Townsend, D., Hunt, R., & Manocha, P. (2022). The path beyond the opportunity wars: Exploring the continued relevance of McMullen and Shepherd (2006) for the future of entrepreneurial action theory. In B. Ozkazanc-Pan, A. E. Osorio, D. K. Dutta, V. K. Gupta, G. Javadian & G. C. Guo (Eds.), *Modern classics in entrepreneurship studies: Building the future of the field* (pp. 155–177). Springer. [https://doi.org/10.1007/978-3-030-61029-6\\_7](https://doi.org/10.1007/978-3-030-61029-6_7)
- [50] Wood, M. S., & McKinley, W. (2020). The entrepreneurial opportunity construct: Dislodge or leverage? *Academy of Management Perspectives*, 34(3), 352–365. <https://doi.org/10.5465/amp.2017.0162>

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