Towards an Integrative Meta-Framework for the Evolutionary Analysis of the Firm

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Abstract

Evolutionary economics, especially in its endeavor to elucidate the behavior of firms, confronts notable integrative challenges that have constrained its ascension as a mainstream alternative within economics vis-à-vis classical paradigms. Central among these challenges are the dispersion, fragmentation, and reductionism inherent in the accumulation of knowledge. Nevertheless, the integration of evolutionary knowledge stands as a main driver for disciplinary advancement, offering a pathway to holistic comprehension, innovation stimulation, methodological enhancement, and improved applicability in policy and practice domains. In response to these impediments, a meta-framework for knowledge integration has been formulated. Rooted in foundational tenets derived from evolutionary biology, evolutionary economics, and firm-specific research, this integrated approach seeks to furnish deeper insights into the complex dynamics governing firms, while providing a more cohesive and structured comprehension of firm evolution by transcending disciplinary boundaries. The article concludes by outlining the implications of this meta-framework for scholarly inquiry and practical application, while identifying prospective avenues for future research.

Keywords: Evolutionary economics, Meta-framework, Firm behavior, Knowledge Integration.

1 Introduction

Evolutionary studies have greatly enhanced our comprehension of fundamental natural and social phenomena, spanning from biological evolution to cultural and societal changes. Originating from humanity's enduring quest to understand life's origins and development, the notion of evolution can be traced to the intellectual explorations of early civilizations in antiquity. Early inklings of transformation of species over time appear in the works of philosophers Anaximander and Empedocles, dating back to the 6th century BC. Nonetheless, it wasn't until the 19th century that evolutionary thought began to crystallize into a formal scientific discipline.

Charles Darwin's seminal work "On the Origin of Species" (1859) laid the foundation for modern evolutionary theory. Darwin proposed the mechanism of natural selection as the driving force behind evolution, whereby organisms with advantageous traits are more likely to survive and reproduce, passing on those traits to subsequent generations. This revolutionary idea sparked intense debate and controversy during and after Darwin's own life, challenging traditional religious and philosophical beliefs about the origins of life. Notwithstanding, evolutionary thought did not solely stem from the contributions of a single man. While Darwin's work catalyzed the formalization of evolutionary theory, its development was the result of a rich tradition and the convergence of multiple disciplines shaped by a diverse array of thinkers spanning various fields.

Early scholars in the tradition of evolutionary thought commonly explored patterns of change and adaptation across biological, cultural, and social contexts. Anthropologists like Herbert Spencer and Lewis Henry Morgan explored the evolution of human societies and cultures, laying the groundwork for the field of cultural evolution. Likewise, sociologists such as Émile Durkheim and Max Weber investigated social change and the evolution of institutions within societies. Moreover, the interdisciplinary character of evolutionary thought became apparent as it began incorporating insights from more diverse fields, including psychology, archaeology, and linguistics. Each discipline provided distinctive perspectives on the mechanisms and processes of change, thereby enhancing our comprehension of evolution in its widest scope.

Evolutionary economics, akin to other evolutionary branches in the social sciences, aligned with tradition by applying principles of variation, selection, and adaptation to economic dynamics. Pioneering economists like Thorstein Veblen and Joseph Schumpeter drew parallels between biological evolution and economic processes, emphasizing innovation, competition, and adaptation's role. The evolutionary theory of the firm, introduced in 1980 by Richard Nelson and Sidney Winter, deepened this connection. They advocated for examining firm behavior and organizational change through the lens of principles such as variation, selection, and retention. Their approach underscored the importance of routines, capabilities, and organizational learning in shaping the evolution of firms. Additionally, evolutionary economics acknowledged historical contingency and path dependence's importance in shaping economic outcomes. Such a perspective underscored that current economic systems result from cumulative historical processes, with past events exerting lasting influence.

As evolutionary theory continued to progress, shedding light on a myriad of phenomena from the origins of life to the behaviors of organisms and human societies, its potential as an integrative framework and alternative to classical thought remains unrealized. This is especially evident in evolutionary economics, where despite continuous efforts to integrate evolutionary principles into economic theory, the field remains on the periphery of the economics profession, largely overshadowed by the dominance of neoclassical models in mainstream economics. An important critique concerns perceived deficiencies in formalization and integration within the field. Furthermore, evolutionary economics confronts contemporary challenges, including those stemming from technological advances, environmental sustainability concerns, and geoeconomic disparities. These challenges are amplified by increasing demands for evolutionary economic principles to inform policy responses to disruptive changes, thereby intensifying scrutiny of the field's efficacy in addressing a wide array of issues, including innovation policies, industrial strategies, and environmental regulations.

This article is an attempt to advance the formalization and integration of evolutionary thinking for firm behavioral analysis. Through the construction of a meta-framework, this research aims to consolidate essential analytical components and their interrelationships. This effort is intended to overcome existing barriers that impede the effective utilization of evolutionary thinking by scholars and industry professionals. Ultimately, the goal is to enrich our comprehension of firms and their behavioral dynamics.

The article is structured to provide an exploration of evolutionary economics and its implications for understanding the behavior of firms. The subsequent sections fulfill distinct objectives to achieve this aim: Section 1: Introduction establishes the foundation by delineating the historical trajectory of evolutionary thought and its integration into economics, highlighting the interdisciplinary nature of evolutionary studies. Section 2: Summary of Weaknesses in the Literature identifies and discusses the main weaknesses in the existing literature pertaining to evolutionary analysis of firms, providing a critical overview of the current state of evolutionary economics research. Section 3: Description and Explanation of the Evolutionary Framework from Biology utilizes Bowler's "Evolution" book as a reference to elucidate the components and main relationships of the evolutionary framework from biology, establishing the theoretical underpinnings for subsequent analysis. Section 4: Construction of a Meta-framework for the Evolutionary Analysis of the Firm proposes a meta-framework tailored to the analysis of firms, integrating insights from evolutionary economics and related fields to provide a

comprehensive approach to studying firm behavior. Section 5: Discussion of the Main Consequences of the Meta-framework explores and discusses the implications of the proposed meta-framework for evolutionary analysis of firms, elucidating its potential contributions to scholarly inquiry and practical application. Section 6: Limitations and Future Lines of Research acknowledges the limitations of the research conducted and outlines potential avenues for future research in evolutionary economics and the analysis of firm behavior. Finally, Section 7: Conclusion offers a succinct summary of the main contributions of the paper, highlighting the significance of the proposed meta-framework and suggesting directions for further exploration in the field of evolutionary economics.

2 Challenges in Integrating Evolutionary Knowledge

The integration of evolutionary knowledge presents a significant challenge for advancing and adopting evolutionary thought in economics and the study of firm behavior. This challenge reflects broader issues within the scientific community, where integration is a fundamental process driving scientific progress. When knowledge becomes too dispersed across various disciplines, fields, and paradigms, it often results in a lack of cohesion and unity in scientific understanding. Moreover, when this dispersion of knowledge is coupled with fragmentation, a common feature of disciplinary progress, both factors can hinder advancement and complicate the synthesis of findings into a cohesive framework. Consequently, establishing connections and identifying commonalities between disparate areas of knowledge becomes increasingly difficult.

As Kuhn argued, different paradigms can be incommensurable, making it challenging for scientists working within distinct frameworks to communicate and build on each other's work [3]. This often leads to the development of specialized terminologies and conceptual frameworks that are difficult to reconcile. As a result, significant insights and breakthroughs may go unnoticed or undervalued due to their confinement within narrow disciplinary boundaries. Foucault noted that discursive formations can develop their own internal logics and rules, constraining what is considered legitimate knowledge [5]. This marginalizes ideas that do not fit neatly within established frameworks.

Furthermore, the lack of knowledge integration poses challenges for the scientific community in addressing complex, real-world problems that require a multidisciplinary approach. Issues such as climate change, public health, and social inequality often encompass interrelated dimensions across the natural and social sciences. Addressing the lack of knowledge integration in evolutionary thought is therefore crucial for overcoming these challenges. This paper examines how dispersion, fragmentation, and reductionism undermine knowledge integration by creating silos, limiting interdisciplinary communication, and fostering narrow research focuses. Additionally, we discuss how our proposed meta-framework can contribute to a more holistic and integrated approach to understanding firm behavior from an evolutionary perspective.

2.1 Dispersion

Knowledge dispersion refers to the widespread distribution of information across diverse sources, disciplines, and domains. It reflects the multiplicity of perspectives, theories, and methodologies that exist within different areas of knowledge. Dispersion is evident in the varied insights found across numerous fields, publications, and researchers. Each discipline contributes its specialized knowledge, creating a rich tapestry of perspectives that enhances the overall understanding within the academic landscape. However, in such a dispersed environment, knowledge takes on different forms and becomes accessible primarily to individuals within specific fields, fostering information asymmetry between disciplines. Experts within their domains can readily access and utilize relevant knowledge, while those outside these fields often encounter barriers that hinder interdisciplinary collaboration and exchange. Furthermore, dispersion promotes specialization within disciplines, as researchers focus deeply on narrow topics within their areas of expertise, further fragmenting knowledge into specialized subfields.

In the field of evolutionary thought, the dispersion of knowledge arises from a complex interplay of historical, interdisciplinary, and methodological factors, highlighting the diverse and multifaceted nature of evolutionary inquiry. Over time, evolutionary theory has given rise to various paradigms and theoretical frameworks, each reflecting different interpretations and emphases within the discipline. Interdisciplinary engagement has been central to this dispersion, intersecting with numerous fields such as biology, anthropology, psychology, sociology, and economics. Each discipline approaches evolutionary phenomena from its unique perspective, leading to diverse interpretations and methodologies. Consequently, evolutionary insights become dispersed across disciplinary boundaries, reflecting the varied lenses through which scholars from different fields view evolutionary processes.

The broad applicability of evolutionary principles to diverse phenomena further contributes to this dispersion. From biological evolution to cultural dynamics and economic behavior, evolutionary concepts resonate across a wide array of domains, resulting in the dispersion of evolutionary insights across disparate fields of study. Methodological pluralism within evolutionary thought further amplifies this dispersion. Scholars employ a variety of empirical, qualitative, mathematical, computational, and comparative approaches to investigate evolutionary processes, each yielding unique insights and perspectives. These methodological preferences vary across disciplines and research traditions, creating a highly dispersed landscape of evolutionary inquiry.

2.2 Fragmentation

Knowledge fragmentation involves the compartmentalization and isolation of information into distinct fragments or disciplines, each characterized by specific boundaries and specialized focus areas. Fragmentation creates disciplinary silos where researchers operate within narrow domains of expertise and research, often with limited interaction or collaboration across fields. These silos are upheld by disciplinary boundaries that define the scope of each field and restrict the flow of information and ideas between disciplines. As a result, researchers within fragmented fields may adopt reductionist approaches, simplifying complex phenomena to fit within their disciplinary frameworks.

The impact of knowledge fragmentation can be profound, creating barriers to the integration and synthesis of knowledge across disciplines. By reinforcing disciplinary boundaries, fragmentation impedes interdisciplinary collaboration and hampers efforts to develop comprehensive, holistic understandings of complex phenomena. Moreover, fragmentation can lead to a narrow perspective among researchers, who may become entrenched in their disciplinary viewpoints and methodologies, potentially overlooking valuable insights from other fields. This narrow focus can result in duplicated efforts as researchers within fragmented disciplines inadvertently replicate studies or fail to consider relevant findings from complementary fields, resulting in inefficiencies and redundancy.

The fragmentation of evolutionary thought into disciplinary silos and compartments is driven by a combination of historical, methodological, and institutional factors that continue to influence the field today. These factors have significantly shaped the evolution and structure of evolutionary studies. Despite efforts to promote interdisciplinary collaboration and integration, disciplinary boundaries persist, often reinforced by institutional structures, funding mechanisms, and academic incentives. These boundaries limit the exchange of ideas and hinder the development of comprehensive, holistic understandings of evolutionary processes. For example, evolutionary economics and evolutionary biology often operate in separate academic spheres, with economists focusing on market dynamics, innovation, and firm behavior, while biologists concentrate on genetic and ecological aspects of evolution. This separation is maintained by distinct funding sources, specialized journals, and academic departments, which can discourage collaboration and the sharing of insights between these disciplines. As a result, important connections between biological evolution and economic behaviors may be overlooked or underexplored, such as how evolutionary principles can inform the understanding of market adaptations and organizational strategies. Overcoming these challenges requires dedicated efforts to break down interdisciplinary barriers, encourage collaboration among scholars from different disciplines, and integrate diverse perspectives within the field of evolutionary thought.

2.3 Reductionism

Reductionism involves dissecting complex phenomena into isolated components or subsystems, often at the expense of understanding the system as a whole and neglecting a holistic perspective. While this approach can yield valuable insights, it can also obscure the broader context and interconnections between different parts of a system. When scholars focus on isolated elements rather than the interactions and relationships among them, reductionism limits the scope of research and the potential for integrative theories and solutions.

In evolutionary economics and the evolutionary analysis of the firm this reductionist tendency appears when scholars concentrate solely on specific aspects or subtopics without considering the interconnectedness and interdependencies within the broader evolutionary framework. For example, researchers might focus exclusively on technological innovation within firms, analyzing how specific advancements influence firm performance. While this focus is valuable, it may overlook the interactions between these innovations and other factors such as market conditions, regulatory environments, and organizational culture. Without considering these interactions, the analysis remains incomplete and potentially misses key insights into the firm's overall evolutionary dynamics.

The risks associated with reductionist approaches are multifaceted. First, reductionism can result in a loss of context, where researchers fail to recognize the broader factors influencing economic evolution and firm behavior. By isolating specific components or mechanisms, scholars may overlook the environmental, social, and institutional dynamics that shape evolutionary processes within the economic landscape. Second, reductionism may fail to capture emergent properties inherent within complex economic systems. For instance, in evolutionary economics, interactions among diverse economic agents and institutions often give rise to emergent phenomena that cannot be understood by examining components in isolation. Failure to recognize and account for these emergent properties may lead to a limited understanding of economic evolution and dynamics.

Furthermore, reductionism may impede the ability to effectively address complex problems. Many economic phenomena, including firm behavior and market dynamics, are inherently complex and multifaceted, requiring a holistic understanding to develop comprehensive solutions. Scholars using reductionist approaches often overlook the interconnections and interactions crucial for understanding complex systems, leading to incomplete or erroneous conclusions that fail to address the full scope of a problem. Ultimately, reductionist approaches that oversimplify these problems may result in inadequate policy prescriptions or managerial interventions that do not address their underlying complexity.

Reductionism can also impede interdisciplinary collaboration and knowledge integration within evolutionary economics and the evolutionary analysis of firms. Given the inherently interdisciplinary nature of these fields, effective research often necessitates integrating insights from diverse disciplines, including economics, biology, psychology, and sociology. Reductionist tendencies restrict researchers' capacity to engage with broader interdisciplinary questions and inhibit the synthesis of knowledge across different domains. Consequently, this overspecialization may stifle the advancement of the discipline by limiting opportunities for innovation and the cross-fertilization of ideas.

3 Why a Meta-Framework?

Despite the absence of a universally accepted definition within qualitative research, frameworks have emerged as instrumental tools bridging the gap between theoretical constructs and empirical observations (Partelow 2023; Mollinga 2008). In recent decades, their utility has transcended disciplinary boundaries, attracting significant attention across a wide spectrum of scientific fields, including the natural and social sciences, technological advancements, education, and environmental studies. This widespread adoption is further evidenced by the routine application of established frameworks by scientific and professional organizations, as well as policymakers worldwide.

The value of frameworks extends to the realm of academic research. They provide a structure for operationalizing and organizing scientific knowledge, fostering the development of a shared language, and promoting standardized research processes (Binder et al. 2013). Broadly, two primary categories of frameworks can be identified: those designed to capture the complex workings of a phenomenon or system, and those focused on simplifying core concepts. Beyond their specific aims, frameworks serve as a resource of reference for scholars and practitioners. They facilitate the navigation of complex interactions between diverse phenomena, ultimately enhancing the analysis and integration of emerging knowledge (Pulver et al. 2018).

From an epistemological standpoint, frameworks, regardless of their development approach (top-down or bottom-up), play a pivotal role in bridging the divide between various levels and scales of scientific knowledge. They connect broader, more general knowledge structures like paradigms or grand theories with more specific levels like models or case. In essence, frameworks are designed to “organize diagnostic, descriptive, and prescriptive inquiry, providing the basic vocabulary of concepts and terms to construct the causal explanations expected by a theory” (Partelow 2023). Ultimately, these tools streamline the scientific process by guiding researchers in study design and offering a foundation of key concepts and measurable, comparable, and evaluable fundamental knowledge. This functionality prevents researchers from constantly “reinventing the wheel” with each new investigation. Instead, frameworks facilitate advancements by allowing researchers to apply them to less explored areas or integrate them with novel knowledge from other disciplines. This functionality prevents researchers from constantly “reinventing the wheel” with each new investigation. Instead, frameworks facilitate advancements by allowing researchers to apply them to less explored areas or integrate them with novel knowledge from other disciplines.

Frameworks further empower researchers by contextualizing their work within a specific field, providing a robust collection of interconnected concepts, theories, and paradigms with demonstrated utility in that domain (Cox et al. 2016). This not only facilitates knowledge synthesis and focus on key concepts and their relationships, but also stimulates scholarly discourse, fosters collaborative and interdisciplinary research endeavors, and lays the groundwork for subsequent empirical studies and effective communication of advancements and discoveries.

Despite their recent proliferation and wide-ranging applications across science, governance, and policy-making, concerns regarding framework creation and use persist. Critics argue that frameworks can become "black boxes," lacking transparency in concept selection and relationship establishment. However, frameworks typically emerge from a foundation of prior knowledge and experience, combined with empirical synthesis processes that integrate existing knowledge with research findings to develop more comprehensive frameworks. Following development, frameworks require operationalization, presenting challenges for both creators and users. Strategies need to be devised for case selection, synthesis activities, and integration with real-world data. These challenges underscore the critical importance of transparent and systematic methodologies for framework synthesis.

3.1 Rationale for Meta-Framework Development

The rationale for constructing a meta-framework stems from several key considerations. Firstly, a meta-framework, essentially a synthesis of existing frameworks, offers a robust methodological approach to address the dispersed nature of knowledge on firm evolution. By integrating insights from evolutionary economics, organizational theory, and related disciplines, our meta-framework establishes a unifying structure that bridges diverse research strands related to firm behavior. This holistic perspective fills the gap between micro-level organizational dynamics and macro-level environmental influences. Given the inherent complexity of this field, a meta-framework serves as a powerful tool for scholars and practitioners. It empowers them to develop more effective strategies for managing organizational change, fostering innovation, and adapting to dynamic market environments, ultimately leading to significant benefits.

Secondly, the meta-framework functions as a methodological bridge between theoretical concepts and empirical observations in evolutionary firm analysis. It provides a structured framework for organizing diagnostic, descriptive, and prescriptive inquiries. This equips researchers with a standardized vocabulary of core concepts and essential terms necessary for constructing causal explanations. This systematic methodology fosters rigor and coherence in research endeavors, enabling clearer interpretations of empirical findings and propelling the advancement of theoretical developments concerning firm behavior.

Thirdly, the meta-framework facilitates interdisciplinary collaboration by establishing a shared language and conceptual framework for scholars and practitioners across diverse disciplinary backgrounds. By transcending disciplinary boundaries, the meta-framework encourages the exchange of knowledge and collaboration among researchers, fostering innovative insights and perspectives. This interdisciplinary approach is increasingly important for addressing complex research questions that necessitate multifaceted analyses drawing from multiple knowledge domains.

Fourth, the inherent step-by-step procedural method employed in constructing the meta-framework ensures a high level of transparency, thus allowing for a clear delineation of the systematic processes guiding data analysis, from descriptive elucidation to explanatory inference. This transparency extends to the researchers' interpretative efforts, ensuring a traceable trajectory of analytical insights throughout any study related to firm behavior.

Fifth, unlike other qualitative data analysis approaches such as grounded theory, narrative methods, or phenomenology, constructing a meta-framework adopts a pragmatic epistemological stance, thereby accommodation to a wider range of data types and research contexts (Goldsmith 2021; Gale et al. 2013). This flexibility is critical for our investigation, as we utilize primary and secondary data from both conceptual and empirical studies across the natural and social sciences. By integrating insights from diverse disciplinary domains, we aim to offer a comprehensive perspective, transcending disciplinary boundaries to gain a nuanced understanding of evolutionary firm dynamics.

In conclusion, the creation of a meta-framework represents a methodological innovation that aligns perfectly with the research objectives of this study. Our meta-framework offers a comprehensive and systematic approach to firm analysis, promoting interdisciplinary collaboration, enhancing theoretical development, and ultimately contributing to the advancement of evolutionary economics.

4 Methodology

The construction of a robust meta-framework requires a systematic, step-by-step approach for synthesizing diverse data and existing frameworks into a cohesive and comprehensive higher-order framework. Each methodological step is designed to ensure organized, rigorous analysis and thorough synthesis of qualitative data. This approach ensures that the resulting meta-framework possesses both theoretical robustness and empirical grounding, ultimately enhancing its practical relevance and applicability. The subsequent section outlines the specific steps employed in this current research.

4.1 Familiarization with Literature

Before delving into the detailed construction of the meta-framework, an exploratory review of the extant literature was conducted covering the fields of evolution in the natural sciences, evolutionary economics, evolutionary analysis of the firm, and related areas within the social sciences, including sociology, anthropology, psychology, and political science. The primary objective was to equip the author with as many different and interdisciplinary perspectives as possible, identify knowledge gaps, grasp the current state of knowledge, and pinpoint the most pertinent theories, models, and existing frameworks. Through this approach, the foundation of the meta-framework would be firmly established upon a bedrock of prior research, ensuring its alignment with established knowledge.

Priority was given to achieving a broad understanding of relevant topics, interdisciplinary connections, and the complexity of the study area, rather than being exhaustive in terms of the number and depth of studies analyzed. Consequently, it included not only high-quality articles from major peer-reviewed databases but also books and conference proceedings whose quality was reviewed and acknowledged. This approach provided a valuable basis for the formulation of the research questions and objectives. While not exhaustive, it facilitated the initial mapping of the intellectual landscape by identifying key themes, recurring patterns, and emerging controversies within the field. Additionally, it offered insights into the diverse perspectives and frameworks developed over the past two centuries.

4.2 Research Questions and Objectives

The insights gleaned from the exploratory literature review provide a springboard for the formulation of clear and concise research questions and objectives. This crucial step serves as the foundation for guiding the subsequent stages of meta-framework construction. The research questions were crafted to address the specific gaps and issues identified within the reviewed literature. This targeted approach ensures that the resulting meta-framework is well-positioned to contribute novel and valuable insights to the field of evolutionary firm analysis. Furthermore, establishing well-defined research objectives plays a critical role in maintaining focus and direction throughout the meta-framework development process. The SMART criteria (Specific, Measurable, Achievable, Relevant, and Time-bound) were employed to formulate these objectives, thereby providing a structured and clearly defined roadmap for the research.

4.3 Specification of an A Priori Meta-Framework

Following the literature review and the establishment of research questions and objectives, the next step involves identifying relevant models to serve as a foundation for the forthcoming framework synthesis process. A seminal work in the field of natural science evolution was chosen due to its twofold significance. First, the work holds widespread recognition within the scientific community for its contributions to the understanding of natural evolution. Second, it offers a valuable historical perspective on the trajectory of evolutionary thought, encompassing both mainstream and divergent ideas. By leveraging this established theoretical and empirical groundwork, the author ensured an efficient and conceptually sound synthesis process.

Building upon this foundational work, the author embarked on crafting an a priori meta-framework. This entailed generating a preliminary list of themes derived from the selected model. These themes would then guide the organization and analysis of data throughout the research. The resulting a priori meta-framework functioned as a structured template for data mapping and coding, promoting consistency and comprehensiveness during the entire synthesis process.

4.4 Systematic Literature Review

Informed by the established research questions and objectives and the a-priori meta-framework, a comprehensive two-pronged systematic literature review was undertaken. The first strand delved into the domain of evolutionary economics, with a particular focus on the analysis of firm behavior through an evolutionary lens. The second strand explored case studies that utilized evolutionary concepts or frameworks to investigate firm dynamics. Each review employed a distinct search strategy to ensure methodological rigor and the identification of high-quality research. Both WOS and SCOPUS databases were targeted to maximize the rigor and quality of the search. The initial systematic review adopted a structured approach to identifying, evaluating, and synthesizing relevant scholarship pertaining to the fundamental tenets and interconnected concepts that characterize the evolutionary view of the firm. To capture the broadest possible range of ideas and perspectives, the review employed broad search terms and an extensive timeframe. The second systematic review focused on case studies that analyzed firm behavior through an evolutionary lens. This review encompassed articles that explicitly mentioned "evolutionary" in their titles and those that analyzed firm behavior evolutionarily without explicitly using the term. To identify the latter category, a qualitative research technique known as "pearl-growing" was employed. This technique metaphorically refers to the process of iteratively accumulating valuable "pearls" of information by expanding the search based on references, citations, or recommendations found in the initial set of identified sources. In this context, the "pearls" were the valuable insights gleaned from the references and citations within the articles identified in the first systematic literature review.

4.5 Data Extraction and Thematic Analysis

The next stage involved a two-step process of data extraction and analysis. First, a systematic data extraction process was undertaken that collected relevant information from the selected studies, including verbatim quotes and key findings supported by the study data. This allowed the capture of all information necessary to address the research questions, ultimately forming a robust empirical foundation for the construction of the meta-framework. Following data extraction, all data were mapped and coded against the a priori meta-framework established earlier. The process involved organizing the data in a meaningful manner to facilitate the identification of emerging patterns and relationships. Data coding was conducted thematically, adhering to the predefined themes identified within the a priori meta-framework. However, the approach remained adaptable. Any relevant data that did not neatly fit these predefined themes were incorporated using an inductive approach, thus facilitating the emergence of new themes and relationships grounded in the data itself and ensuring that the analysis captured the full breadth of relevant information, even if it fell outside the initial framework.

To enhance the rigor and efficiency of this process, qualitative data analysis software Atlas.ti was employed. While Atlas.ti does not supplant the researcher's critical role in data analysis and interpretation, it significantly bolsters the methodological rigor, efficiency, and overall quality of the research endeavor. Atlas.ti played a key role in streamlining data management and coding tasks. Additionally, it facilitated visual analysis, enabling the identification of patterns, themes, and relationships that might be less apparent through strictly textual methods.

4.6 Final Meta-Framework Development

In the last stage of the research, the focus shifted towards refining the a priori meta-framework and ensuring the robustness of the analysis. A rigorous review process was conducted to ensure the reliability and relevance of the coding and identified themes derived from the coding process. This involved critical examination of the whole work, carefully evaluating each theme to ensure faithful representation of the data. As a result, the initial a priori meta-framework was further refined to achieve a more accurate reflection of the extracted data.

Subsequently, the author interpreted the relationships between the themes, aiming to generate meaningful insights into how these themes interact and influence one another. This interpretation, grounded in both the empirical data and the original a priori framework, culminated in a revised conceptual meta-framework. This revised framework offers a coherent and comprehensive explanation of the phenomena under investigation.

By adhering to these systematic steps, a final meta-framework was constructed, characterized by both rigor and adaptability. The meta-framework offers valuable insights that contribute to our understanding of evolutionary firm behavior. The transparent, comprehensive, and empirically grounded approach employed in its development ensures the meta-framework's robustness as a tool for advancing both theoretical and practical knowledge in the field of evolutionary firm analysis. Notably, the final meta-framework integrates the a priori themes with those newly identified during the systematic literature reviews. This comprehensive model captures the full spectrum of relevant themes and their interrelationships, providing a nuanced and detailed understanding of the studied data.

5 Results

5.1 The A Priori Meta-Framework

Unlike other framework synthesis approaches that typically develop the a priori framework through extensive literature review, consultations, and in-depth topic expertise, our approach did not involve these exhaustive preliminary processes. Instead, the development of the a priori framework began by selecting a seminal work from the existing literature that thoroughly covered the key ideas and relationships defining the concept of evolution in natural sciences. This foundational work enabled a more rapid and efficient coding and synthesis process compared to traditional meta-framework construction methods. By bypassing the need for extensive preparatory work, our approach offers a more streamlined and effective method for conducting framework synthesis, allowing for a greater focus on the review process itself.

The selected work was Peter J. Bowler's seminal book, "Evolution: The History of an Idea" (2003), which examines the historical trajectory of evolutionary thought and offers a comprehensive foundation for understanding the development of economic systems. Bowler's interdisciplinary perspective highlights the dynamic nature of economic processes, portraying them as evolving systems subject to change over time. Moreover, his analysis provides valuable insights that can enhance research in evolutionary economics by elucidating the historical roots of evolutionary ideas and their relevance to economic analysis.

A key aspect of Bowler's work relevant to our research is its examination of the interplay between cultural, scientific, and anthropological factors in shaping evolutionary theories. Bowler traces the development of evolutionary thought from its origins in ancient Greece to its modern understanding, highlighting how societal beliefs and values influenced these concepts. This insight is particularly valuable for evolutionary economists, as it underscores the importance of understanding the cultural and ideological contexts in which economic systems emerge and evolve.

Bowler's exploration of the contributions made by key figures to evolutionary thought is another significant contribution to our a priori meta-framework. He examines the ideas and theories of prominent thinkers, elucidating their influence on the development of evolutionary theory. Understanding this intellectual lineage provides our a priori meta-framework with insights into the historical roots of contemporary economic theories and methodologies. Bowler's analysis also highlights the diversity of perspectives within evolutionary thought, enriching our meta-framework with a broad spectrum of ideas to draw upon in the analysis of evolutionary economic systems.

Additionally, Bowler's book delves into the controversies and debates surrounding the concept of evolution, shedding light on the varying interpretations and contestations of evolutionary theory throughout history. This aspect is particularly relevant for constructing our a priori meta-framework, as it emphasizes the complex and multifaceted nature of economic evolution. By examining historical debates over evolutionary theory, our meta-framework gains a deeper appreciation for the contested nature of economic processes and the diverse array of factors that shape them. Bowler's nuanced analysis encourages critical engagement with evolutionary concepts and methodologies, fostering a more robust and interdisciplinary approach to studying economic systems.

In conclusion, Bowler's comprehensive treatise on evolution in natural science provides a robust foundation for delineating themes and aggregate dimensions, serving as a template against which to code the data extracted from the literature review on evolutionary economics and the evolutionary view of the firm conducted in subsequent stages of this research. Consequently, each theme within the a priori meta-framework encapsulates essential aspects of evolutionary theory, illuminating the intricate mechanisms governing evolution and evolutionary behavior. The resulting a priori meta-framework reflects the following key themes (Fig. 1):

5.1.1 Unit of analysis

In the context of evolutionary studies, the unit of analysis refers to the fundamental entity upon which observations and analyses are focused. Historically, the choice of the unit of analysis has evolved. Initially, emphasis was placed on the organism, defined in biology as a unique living being—such as a plant, animal, or microorganism—capable of independent existence and reproduction. This focus later shifted to the population, and subsequently, following the modern synthesis, to the gene. Analysts must clearly identify the primary unit of evolutionary analysis within each system under study.

Despite the shifts in the locus of analysis, the individual organism remains a cornerstone in evolutionary studies, representing a single, discrete entity within a given population. However, distinguishing between the individual organism and the population as units of analysis is crucial for any evolutionary study. The individual organism represents a single instance of life, while the population comprises a group of organisms of the same species occupying a defined geographical area and sharing genetic similarities. The individual organism serves as the building block of the population, with its traits, behaviors, and adaptations contributing to the collective dynamics of the population. This fundamental differentiation between individual and population units of analysis can be illustrated in Darwin's theory, which encompasses both types of units. Natural selection operates at the level of the individual organism, influencing the frequencies of traits within a population over time.

The selection of a specific unit of analysis significantly influences the scope and focus of evolutionary approaches. Analyzing individual organisms allows researchers to examine specific

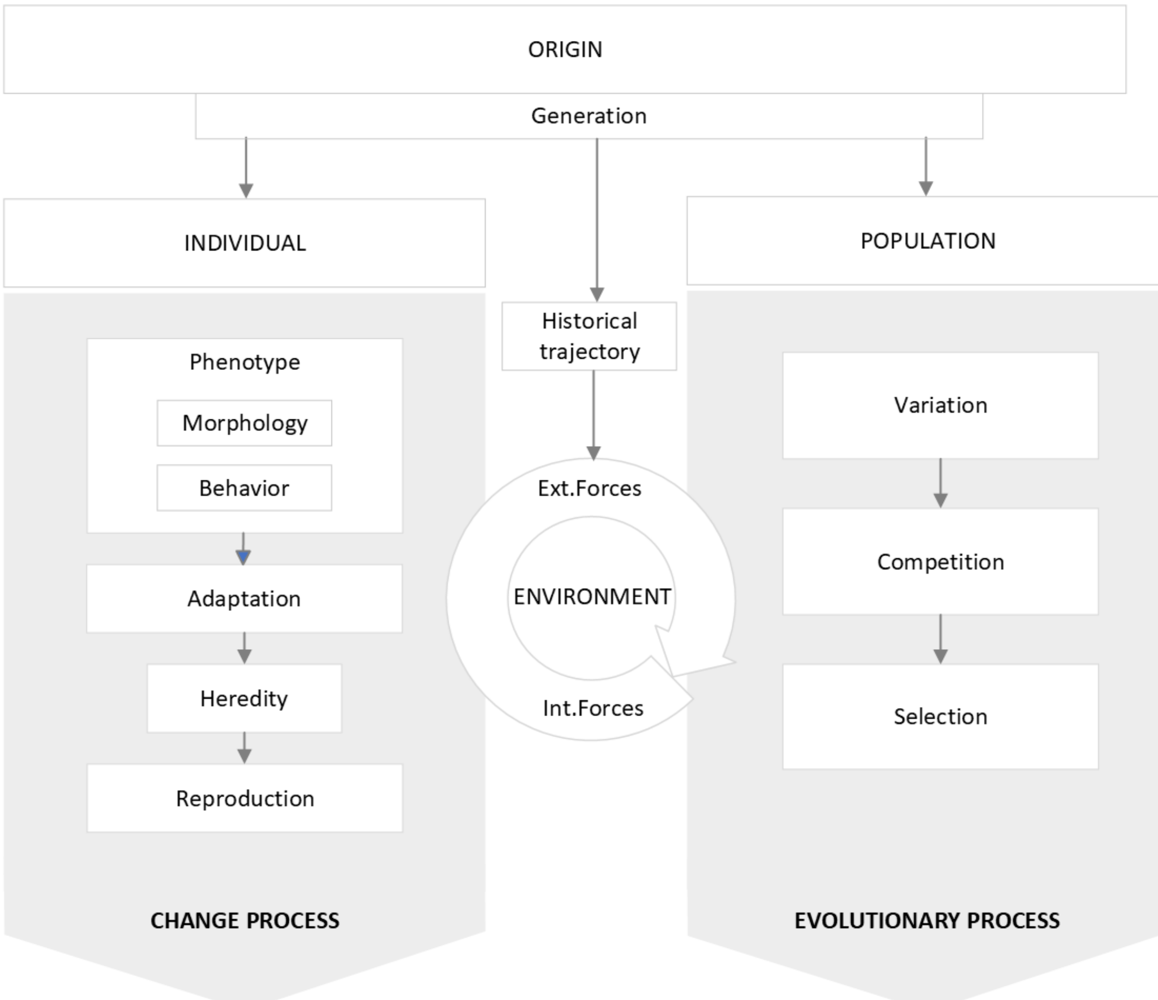

Figure 5.1: Fig1. A priori meta-framework for evolutionary systems analysis. Source: own elaboration based on Bowler (2003)

traits, behaviors, and adaptations within a single entity, providing insights into microevolutionary processes such as natural selection and genetic drift. Conversely, studying populations enables researchers to investigate macroevolutionary patterns and trends, such as speciation and diversification, by considering the collective dynamics and genetic variability within and between populations. While the individual organism offers granularity in understanding the mechanisms of evolutionary change at a local level, the population provides a broader perspective on the dynamics of species evolution and adaptation over time. Both units of analysis are integral to comprehensively elucidating the complexities of evolution within natural systems. They highlight the interplay between individual-level characteristics and population-level dynamics in shaping the evolutionary trajectory of species.

5.1.2 Origin

The emergence of a population from individuals significantly shapes the evolutionary trajectory of the natural system. Therefore, investigating the origin of individuals is paramount in evolutionary analysis, as it addresses fundamental inquiries regarding the emergence, diversification, distribution, and persistence of life forms on Earth. This line of inquiry involves examining evidence from the past to gain insights into the mechanisms governing the origination and divergence of new species from common ancestors. Subsequently, attention shifts towards understanding the trend towards increased complexity and the underlying forces driving this evolutionary trend.

The concept of “origin” in evolutionary studies is closely intertwined with that of “generation” and “developmental processes”, collectively enhancing our understanding of evolutionary dynamics. While the study of “origin” focuses on the emergence of new species or lineages, marking the beginning of their subsequent evolutionary trajectory and setting the stage for evolutionary change within populations, the study of “generation” concerns the production of offspring or new individuals within a population. In essence, while the study of “origin” examines how new species arise and diverge from common ancestors, the study of “generation” delves into the mechanisms by which new individuals are generated and their contributions to genetic variation and evolutionary change within populations. Thus, an examination of reproductive processes and their impacts on population and species dynamics becomes essential.

Ultimately, “developmental” constraints also play a key role in shaping the evolutionary trajectory of individuals and populations. Embryonic development imposes constraints on the types of changes organisms can undergo over time, highlighting the integral role of embryological processes within evolutionary systems. Exploring the patterns and constraints of embryonic development provides valuable insights into the mechanisms propelling evolutionary change and diversification in natural systems.

5.1.3 Evolutionary vs Change process

Evolutionary processes involve dynamic mechanisms that drive changes at the population level across successive generations. Instead of acting solely on individual organisms, these mechanisms accumulate inherited changes within populations. Studying evolution at the population level provides insights into broad patterns of genetic variation, selection pressures, and the processes of speciation. Key to this analysis is gene flow, which facilitates the spread of advantageous traits and genetic diversity among populations. Conversely, isolation mechanisms like geographic or reproductive barriers restrict gene flow, promoting genetic differentiation and potentially leading to the emergence of new species through speciation. Natural selection operates on this genetic variation, favoring traits that enhance survival and reproduction in specific environments. Genetic drift and mutation further contribute to population dynamics, offering insights into overarching evolutionary patterns and collective population dynamics.

At the core of evolutionary theory also lies the change process occurring at the level of individual organisms or units. These changes encompass phenotypic, behavioral, or genetic mutations that occur in response to environmental pressures and internal dynamics. Once individual changes occur, they contribute to population genetic variation. Natural selection acts as a guiding force in this context, favoring traits that confer reproductive advantages or enhance survival in specific ecological niches. This selective process, influenced by environmental factors, determines the organism's adaptation and reproductive success, thereby impacting its chances of survival. Over successive generations, advantageous traits increase in prevalence within populations, while less favorable traits diminish in frequency.

An evolutionary approach must therefore emphasize the interplay between changes occurring at the level of individual organisms and the broader evolutionary processes operating at the population and species levels. This integrated perspective should elucidate how changes at the individual level contribute to the evolutionary trajectory of species over time. By examining the interaction between individual-level adaptations and population-level dynamics, researchers can gain deeper insights into the mechanisms driving species evolution and adaptation across diverse ecological contexts.

5.1.4 Environment

The environment plays a pivotal role in shaping evolutionary processes, providing the stage upon which populations and individuals interact and adapt. Within natural systems, the environment encompasses a spectrum of biotic and abiotic factors that influence species distribution, behavior, and evolutionary trajectories. Biotic factors involve interactions among living organisms, encompassing phenomena such as competition for resources, predation, and symbiotic relationships. Abiotic factors, on the other hand, include non-living elements like climate, geography, and physical resources. Together, these factors contribute to the dynamic complexity of ecosystems, demanding species to continuously adapt for survival and reproduction.

In addition to these environmental factors, evolutionary processes are driven by a series of exogenous and endogenous dynamic forces, each with varying intensities and directional impacts. Exogenous forces originate from external sources beyond individual organisms or ecosystems, such as climatic fluctuations, geological events, and rare phenomena like asteroid impacts. These external influences exert significant effects on habitats, species distributions, and overall evolutionary trajectories by modifying environmental conditions and triggering evolutionary responses. Conversely, endogenous forces arise from within organisms or ecosystems or result from interactions among organisms. These forces encompass genetic mutations, physiological responses, and ecological interactions within populations or ecosystems, shaping genetic compositions and population dynamics over time. Environmental forces and conditions are pivotal in determining organism fitness, steering natural selection, and molding evolutionary paths. This process compels species to develop traits and behaviors tailored to their environmental niche, thereby increasing their chances of survival and reproductive success.

Both factors and forces coexist synergistically, each playing complementary roles: factors establish the foundational conditions and contexts for life, including environmental conditions and biological interactions, while forces actively drive evolutionary changes within these established contexts. Factors thus create the stage upon which evolutionary dynamics unfold, while forces shape the evolutionary paths by influencing genetic diversity and population-level adaptations over successive generations. Therefore, comprehending the complex interplay between environmental factors and dynamic forces is essential for elucidating the mechanisms driving ecosystem evolution over time. This understanding is crucial for unraveling species adaptation, biodiversity patterns, and the resilience of ecosystems in response to environmental changes and disturbances.

Ultimately, the environment is bounded by its historical trajectory. Past events such as environmental disturbances and climatic shifts leave enduring impacts on ecosystems, influencing species composition, habitat availability, and biodiversity patterns. Ecosystems with long histories often exhibit greater biodiversity and genetic resilience, while disturbances can create legacies that restrict adaptation. Integrating historical perspectives into evolutionary analysis provides valuable insights into path-dependent processes, informing conservation strategies aimed at enhancing ecosystem resilience.

5.1.5 Phenotypic traits

The structural and behavioral traits of individual organisms are fundamental to evolutionary dynamics within natural systems. Structural traits include physical characteristics such as morphology, anatomy, and physiology, which determine an organism's form and function. These traits are crucial for the adaptation of organisms to their environment and their interactions with other species. Behavioral traits, on the other hand, encompass actions and responses exhibited by organisms in their environment, including feeding behaviors, mating rituals, communication signals, and social interactions.

The interplay between structural and behavioral traits shapes the ecological niche occupied by organisms and determines their fitness within a given environment. Organisms with advantageous traits are more likely to survive and pass on their genes to future generations. This process leads to the emergence, loss, or modification of traits, thereby shaping the organism's overall adaptive strategy. By examining the morphological, physiological, and behavioral adaptations of organisms, valuable insights can be gained into the strategies employed by species, the dynamics of ecological communities, and the co-evolutionary processes that shape biodiversity over time.

5.1.6 Adaptation

Adaptation is a fundamental mechanism driving evolutionary change at the individual level within natural systems. Organisms continuously adjust their traits, behaviors, and physiological processes in response to selective pressures exerted by the environment. At its core, adaptation enables organisms to enhance their fitness and survival in specific ecological niches. Through the process of natural selection, individuals with traits that confer a reproductive advantage or improve survival under prevailing environmental conditions are more likely to pass on their genes to future generations. This process leads to the accumulation of adaptive traits within populations, increasing their overall fitness and resilience to environmental challenges.

Adaptation occurs through various mechanisms, including phenotypic plasticity, genetic mutations, and behavioral adjustments. Phenotypic plasticity allows traits to adjust to environmental cues, while mutations introduce genetic variation. Behavioral adaptations optimize resource use, predator avoidance, and reproduction. Understanding adaptation at the individual level is crucial for uncovering the mechanisms driving evolutionary change and species diversification within natural systems. It can also shed light on species' adaptive strategies, the emergence of novel traits, and the dynamics of ecological interactions along a period of time.

5.1.7 Heredity

Heredity refers to the transmission of genetic information from one generation to the next, playing a central role in evolutionary processes. Genetic material, encoded in DNA molecules, contains the instructions for an organism's development, growth, and functioning. The mechanisms of heredity involve the replication and transmission of genetic material through processes such as mitosis and meiosis. Genetic variation arises from mutations, genetic recombination, and other mechanisms, leading to differences in traits among individuals within populations. Understanding heredity is essential for elucidating the mechanisms driving evolutionary change, as it influences the diversity, adaptation, and persistence of species over time.

Heredity is linked to reproduction as it governs the transmission of genetic information from parent to offspring. This connection is vital because heredity, through the transmission of DNA, ensures the continuity of genetic traits across generations, providing the raw material for evolutionary change. Additionally, genetic variation resulting from mutations and recombination during reproduction introduces diversity within populations, fueling the process of natural selection and facilitating adaptation to changing environmental conditions. Thus, investigating the relationship between heredity and reproduction is crucial for unraveling the mechanisms that underpin individual change processes and their broader implications for evolutionary dynamics within natural systems.

5.1.8 Reproduction

Reproduction is a fundamental process driving evolutionary dynamics at the individual level. Through the production of offspring, organisms perpetuate their genetic lineage and pass on hereditary traits, ensuring the continuity of life and preserving genetic diversity within populations. Both sexual and asexual reproduction contribute to genetic variation, enriching the population's genetic pool. Various factors, including mate choice, mating behaviors, reproductive timing, and reproductive success, influence the reproductive process, thereby impacting the genetic composition and evolutionary trajectory of species.

Modern evolutionary theory emphasizes reproductive success as the primary driver of selection, with the ability to transmit genetic information to offspring being paramount. This shift towards a focus on reproductive success has led to increased research on sexual selection and reproductive mechanisms, including the role of geographic barriers in species diversification. Understanding these mechanisms is crucial for comprehending evolutionary processes in both natural and other systems. However, this perspective has faced criticism, notably from Stephen Jay Gould, who argued against it (2002). Ultimately, examining the reproductive process at the individual level is key to generating insights into the adaptive strategies employed by species, the preservation of genetic diversity, and the evolutionary forces influencing populations over time.

5.1.9 Variation

In evolutionary science, "variation" refers to the diversity of traits and characteristics observed within populations, shaped by underlying genetic and environmental factors. Understanding variation is integral to the study of populations as it reveals the range of phenotypic and genotypic differences within and among species. Variation is intrinsically linked to competition and selection, as individuals with advantageous traits are more likely to survive, reproduce, and pass these traits to future generations. This differential reproductive success propagates favorable traits over successive generations, driving evolutionary change.

Moreover, variation is closely connected to the concept of mutation, which introduces new genetic variants into populations. While not all mutations result in significant changes, with many being neutral, some can lead to notable phenotypic differences that may confer advantages or disadvantages. The evolutionary analyst will need to consider the role of the environment in determining which mutated traits spread within a population and which do not.

5.1.10 Competition

Competition is a fundamental force driving evolutionary dynamics within natural systems. It arises when organisms vie for limited resources such as food, water, or territory. This competitive pressure favors traits that provide a competitive edge, leading to evolutionary changes over time and the inheritance of these beneficial traits by offspring. Within populations, competition manifests in various forms, including direct competition for resources, interference competition through aggressive interactions, and exploitative competition where one species outcompetes another for resources. These competitive interactions can lead to niche differentiation strategies, where species partition resources to reduce competition and coexist within the same habitat. Additionally, competition can drive evolutionary innovation and adaptation, as species evolve traits and behaviors to outcompete rivals. This dynamic can result in the diversification of species and the development of complex ecological interactions over evolutionary timescales.

Ultimately, competition sets the stage for natural selection to act. It results in the accumulation of adaptive traits within populations, while less advantageous traits are outcompeted and reduced in frequency. Understanding competition dynamics is therefore crucial for unraveling the mechanisms behind species interactions, community dynamics, and evolutionary trajectories in natural ecosystems. Through the study of competitive interactions and their consequences, the evolutionary analyst can gain insights into the processes shaping biodiversity, ecological resilience, and ecosystem stability.

5.1.11 Selection

Selection mechanisms operate on the diversity of individual units, favoring traits that confer competitive advantages and improve survival. These processes are crucial drivers of evolutionary change. Natural selection, a primary mechanism, favors traits that improve an organism's fitness and reproductive success in a given environment. Through this process, individuals with advantageous traits are more likely to survive and reproduce, thereby passing on their genetic material to subsequent generations. This differential reproductive success leads to the accumulation of beneficial traits within populations, driving evolutionary adaptation to changing environmental conditions.

However, although natural selection is a cornerstone of evolutionary theory, selection operates through various mechanisms, including directional selection, stabilizing selection, and disruptive selection. Directional selection shifts traits towards one extreme, stabilizing selection maintains the status quo within a population, and disruptive selection leads to divergence. Understanding these selection processes is crucial for elucidating the mechanisms driving evolutionary change and biodiversity within natural systems.

6 Discussion

The framework we have described categorizes the engagement of participants in research agenda setting in terms of the types of people involved, the degree of public involvement, and the initiators of the engagement. It combines and extends concepts proposed by Arnstein9 and Mullen et al.12 The framework is consistent with an eight-dimensional framework described by Byrt and Dooher. Oliver et al. (2008)

Our review findings provide some answers to Boote et al.Õs questions7: how can public involvement be conceptualized; how and why does public involvement influence health research; and what factors are associated with success?. Oliver et al. (2008)

In many ways our analysis drew similar conclusions to research addressing public participation in health services. We found that lay (...) Oliver et al. (2008)

Particular success has been achieved by a research agenda setting exercise that addressed the key dimensions of the framework by com- bining the benefits of representative consultation with iterative collaboration and explicit decision making.64 Acomprehensive evaluation of process and outcome concluded that the (...) Oliver et al. (2008)

Our framework has been since used in a systematic review of involvement in a broader range of activities: developing health-care policy and research, clinical practice guidelines and patient information.65 Use of the framework in this review ensured that different methods of involvement were described in comparable terms, and it enabled the review to highlight areas where no evidence was available at all. The review showed clearly that no trials to date have evalu- ated different degrees of involvement, different forums of communication, lay involvement in decision making, or the provision of training or personal or financial support for lay involvement. Oliver et al. (2008)

The SEARCH framework has been developed as a tool to support future research and practice in positive education and to help overcome (...) Waters and Loton (2019)

SEARCH is a data-driven, multidimensional and actionable framework, comprising six evidence-based pathways to foster wellbeing. The higher-order nature of these path- ways provides a comprehensive and integrated focus whilst still (...) Waters and Loton (2019)

To further establish the utility of SEARCH for school students the current review paper examined whether the existing evidence from published positive education interventions mapped on to the six pathways. Eighty-five peer-reviewed intervention studies were identified that had tested the *effects of each of the SEARCH pathways on students. The interventions were tested in school students ranging from ages (…)Waters and Loton (2019)*

The intervention studies showed a consistent pattern of evidence that each of the six pathways can be effectively targeted to improve wellbeing and academic outcomes, although tests of efficacy were not universally significant. Positive(…) Waters and Loton (2019)

6.1 Substantive findings / 6.2 Strengths and limitations of the review / 6.3 Methods of primary studies / 6.5 The context of previous 'views' research / 6.6 Policy context Brunton et al. (2006)

6.1 Using SEARCH as a Meta-Framework to Guide Future Research

We offer SEARCH as a useful framework to help researchers scaffold and build the science of positive education. For example, when researchers are designing and/or evaluating (…) A positive consequence of this is that it may create greater connections amongst researchers and foster stronger cross-pollination across topics when pulled together by an overarching framework like SEARCH. Waters and Loton (2019)

One potential avenue ofresearch using SEARCH may be in developmental psychology where the framework can be used to create an age-stage appropriate scope and sequencing of well-being curriculums. In addition, research may also show that certain pathways are needed to be developed earlier than other pathways in certain ages (…) Such developmental questions on how to best build wellbeing over time can be scaffolded by using the SEARCH meta- frame-work.@waters2019search*

6.2 Gaps in Positive Education Research

The current review of existing positive education literature has identified a number of gaps that can be addressed through future research. First, (…) Waters and Loton (2019)

Another gap identified in this review paper is the disparity of research conducted between the six pathways in positive education interventions (…) Waters and Loton (2019)

Finally, this review points towards the need for more RCT designs to be used when testing the effectiveness of positive education interventions (…)Waters and Loton (2019)

One untapped area for future research is the effect of context and where and how the interventions are delivered. In the current review, the bulk of the interventions were (…)Waters and Loton (2019)

6.3 Using SEARCH as a Meta-Framework to Guide School Practice

Waters and Loton (2019) **Note: meter aquí el archivo de "Implications"**

SEARCH is not only an evidence-based framework to guide research in the field, it is also a framework that can guide practical application in schools, something that White and Kern (2018) highlight as being ofcentral importance.We offer SEARCH as a framework to assist schools when implementing positive education interventions in a co-ordinated manner across different year levels and across all areas of the school (...) Waters and Loton (2019)

SEARCH provides a data-driven, action-research informed framework for teachers to use when designing positive education interventions. Educators are encouraged to think not only about the content ofthe intervention but how that intervention can be used to build one or more of the higher-order pathways ofwellbeing. For example, while (...) Waters and Loton (2019)

Beyond the design ofindividual positive education interventions, SEARCH can be used to design larger wellbeing curriculums. Such curriculums can teach students how to (...) Waters and Loton (2019)

School leaders and administrators can find strategic and consistent ways to infuse SEARCH into elements of the school that impact faculty and staff such as recruitment and selection, performance development, professional learning, employee wellbeing programs and staff/faculty room culture. A key question for school leaders prompted by the SEARCH framework is 'How can I intentionally create a culture that fosters strengths, emotional management, attention and awareness, relationships, coping and habits and goals for all the adult members of the school?Waters and Loton (2019)

6.4 The Use of a Synthesis Method

There are arguments about whether it is feasible or acceptable to conduct syntheses of qualitative evidence at all,41 and whether it is acceptable to synthesise qualitative studies derived from different traditions. The distinctions, tensions and conflicts between these have been vividly described.@dixon2005synthesising

Perhaps even more likely to generate controversy are attempts to synthesise qualitative and quantitative evidence. It is evident from the discussion above that synthesis of diverse forms of evidence will generally involve conversion of qualitative data into quantitative form or vice versa. Dixon-Woods et al. (2005)

Should reviews start with a well-defined question and how many papers are required? The issue of questions is an important one for syntheses. It will be clear that the methods described above will be more suited to some questions than others: for example questions concerning causality may be better suited to qualitative comparative analysis than questions concerned with the production of mid-range theory, which might be better suited to meta-ethnography. The *issue of how questions should be identified and formulated in the first instance is one on which there is much uncertainty.*

Estabrooks et al, like many in the systematic review community, argue that review questions should be selected to focus on similar populations or themes.43 However, others point out that in primary qualitative research, definitions of the phenomenon emerge from the data.15 Whether one should start with an a priori definition of the phenomenon for purposes of a secondary synthesis is therefore an important question.@dixon2005synthesising

A related issue is how to limit the number of papers included in the review. One approach is to narrow the focus. An alternative strategy is offered by theoretical sampling, used in primary qualitative research with a view towards the evolving development of the concepts. Sampling continues until theoretical saturation is reached, where no new relevant data seem to emerge regarding a category, either to extend or contradict it.45 It has been suggested that this approach would also be suitable for selecting papers for inclusion in reviews.46–48 However, the application of this form of sampling has been rarely tested empirically, and some express anxiety that this may result in the omission of relevant data, thus limiting the understanding of the phenomenon and the context in which it occurs. Dixon-Woods et al. (2005)

Appraising studies for inclusion The issue of how or whether to appraise qualitative papers for inclusion in a review has received a great deal of attention. The NHS CRD guidance emphasises the need for a structured approach to quality assessment for qualitative studies to be included in reviews, but also recognises the difficulties of achieving consensus on the criteria that might constitute quality standards.5 Some argue that weak papers should be excluded. Others, however, propose that papers should not be excluded for reasons of quality, particularly where this might result in synthesisers discounting important studies for the sake of 'surface mistakes', which are distinguished from fatal mistakes that invalidate the finding.Published examples include reviews that have chosen not to appraise the papers,14 as well as those which have opted to appraise the papers using a formalised approach.22 If the argument prevails that some quality appraisal is necessary, the problem then arises as to how this should be undertaken. Dixon-Woods et al. (2005)

Conclusions There is an urgent need for rigorous methods for synthesising evidence of diverse types generated by diverse methodologies. These methods are required to meet the needs of policy-makers and practitioners, who need to be able to benefit from the range of evidence available. Dixon-Woods et al. (2005)

6.5 Practical Implications

6.5.1 Evolutionary analyst

One of the practical benefits derived from the present proposal of formulating an evolutionary systems analytical framework is to determine the need to have professionals with an evolutionary analyst profile. An evolutionary analyst is understood to be an academic or professional who has a clear and deep understanding of the evolutionary functioning of systems and who is capable of using rigorous analysis and tools to determine the factors that explain their essence and elements of change.

6.5.2 Prediction ability

If we are able to acquire a deep understanding of the functioning of the evolutionary system, its components, behaviors and flow of changes, we can then better foresee in which direction the evolutionary system is moving and glimpse whether the system has the capacity to survive or, on the contrary, is doomed to disappearance.

It is worth considering the possibility of whether, based on increasingly deeper knowledge of the evolution of a system, it would be possible to act on the future of the system. In other words, if it could be feasible to design your own plan and carry it out based on the knowledge generated about the evolution of the system.

To what extent is the system under observation random in change or does it evidence a logic that can be known and even altered based on our desires or needs?

6.5.3 Manipulation of the system and its programmability

If they were really able to manipulate the system as we wish, on what elements would it be most feasible to do so? Would it be possible to act on both the structural and behavioral elements, only on one of them? Being able to act on a known evolutionary system would open new and great opportunities to design systems that meet a wide diversity of needs.

The above would necessarily entail having to assess the ethical problems of altering the course of nature and the new problems that would emerge by distorting the natural mechanisms of the functioning of life and society. The opposite position would be to conclude that the system is unalterable and we cannot intelligently design it to satisfy our desires.

Society would go from a stage in which social systems are considered elusive to another in which we would be able to know to what extent their evolution is random, to what extent there is causality and to what extent they are programmable.

6.5.4 Inform and activate policies

An evolutionary analysis framework can serve to inform who cannot support themselves, namely, who is more likely to survive and continue competitive, and who is threatened by disappearance.

Identifying who dominates over whom, that is, elucidating the relationships and power structures has great significance, but it is also a way to understand how species advance. In fact, the process of replacement or extinction of species is an essential aspect to understand human progress.

The level at which the analyst expects to inform policy, or the level of contribution expected by decision makers from an evolutionary model, is a factor in determining the level of analysis to be used in the "struggle for existence."

Additionally, if education (education policies) could improve individuals, the benefits could perhaps be passed on through inheritance (this is a Lamarckian view).

6.5.5 Overcoming the barriers that prevent systematic struggle

From the RQs: Another question that the evolutionary analyst can try to resolve is whether the individual **permits the struggle** to take place and, if not, to what extent this weakens the individual and, therefore, that the individual enters into a process of degeneration that leads to a replacement by another individual.

This leads us to the recommendation, in some circumstances mediated by policies, that the struggle does not have constraints that condition it. Thus, as the environment continues to pose challenges that must be faced (resolved) by the individual, progress will continues.

6.5.6 Eugenics of individuals

The above leads us to the problem of eugenics, and the reflection on to what extent the system must ensure that the selection produces and there are no barriers for it to unfold its effects.

6.5.7 The connection with complex systems

The analysis of evolutionary systems demonstrates a connection with complex systems, such that species should be seen as complex systems with an enormous amount of variation, stimulated by selection.

6.5.8 The contribution of this review to policy

The key message from this systematic review is that interventions will not work unless public views about the value, safety, benefits and costs of walking and cycling are taken into account. This information will thus be of interest to parents and children, government policy-makers at the national and local level, schools, and research funding bodies. Policy-makers need to understand that perceived safety is a key influence on walking and cycling, but that environmental improvements and facilities can encourage a shift away from car culture.@brunton2006synthesis

6.6 Framework Thematic Discussion

6.6.1 On Evolution

When addressing the study of an evolutionary system, it is of paramount importance to first elucidate what **the unit** of the system will be, on which the entire conceptual and methodological apparatus of evolution will be applied. This is a discussion that has changed over time, having moved from the individual organism to what is currently considered a more correct approach, the gene. What the above means is that instead of prioritizing "adaptive fitness" in the analysis, today it seems more appropriate to focus on the reproductive success of the individual. This new perspective has given rise to the movement of ultra-Darwinism.

The analysis of evolutionary **stratigraphy**, that is, the analysis of the evolutionary process cut into layers, can provide valuable evidence and insight about the evolution followed by each stratum, as well as the relationships that exist between strata. Additionally, it may also be valuable to study the global stratigraphy of the system, that is, the system of layers resulting from aggregating lower-level strata into higher-level strata, since this can suggest new stratal relationships that previously remained hidden from view of the evolutionary system.

The geological **law of superposition**, which states that in any sequence of undisturbed sedimentary rocks, each layer of rock is younger than the one below it and older than the one above it, can be used analogously in the analysis of an evolutionary system, thus establishing that each lower layer manifests a behavior on which the behavior of the upper layer is based.

6.6.1.1 Hierarchy

The idea of hierarchy involves something on top down to somethinge else.

Once the evolutionary system has been sliced into strata and the evidence that each one individually provides, as well as that of the global stratigraphic system, has been analyzed, the evolutionary analyst will be able to infer the **hierarchical structure** of evolutionary elements that characterize the system under observation.

6.6.1.2 Classification

A classification or taxonomy is a procedure used to better understand the diversity (and variation) of organisms.

When studying the evolution of a population, building a **classification or taxonomy** of units (species) becomes relevant. This requires discipline and deep analysis into the building blocks and the relationships (or degrees of relationships) that stand between individuals. By formulating a classification/taxonomy, new avenues can be opened that allow the evolutionary analyst to trace (and understand) the past of the units and make it easier to foresee the next steps that the unit will go through.

With a classification or taxonomy the analyst can study the diversity of the units (species) based e.g. in their morphology, as well as the ecological relationships that exist between them.

In the history of evolution, three major frameworks for classifying species are usually proposed:

1. Chain of being (Bonnet) -> it is a hierarchical chain of relationships
2. The rope of being (Rubinet)
3. Lineo taxonomy based on visible resemblances (with no hierarchy)

6.6.1.3 Miscelaneous

The idea of the extent to which the **history of "life"** has been progressive but in an irregular way.

The idea of **"emergent evolution"** (Lloyd Morgan) which highlights the new high-level properties that appear as evolution reaches a certain level of complexity.

6.6.2 On the Origin

The idea of the Origin is consubstantially associated with the idea of an **end**, since everything that begins must necessarily have an end.

The problem of origin is closed related to the **problem of generation**, thus the evolutionary analyst must elucidate whether the origin of the unit is spontaneous, preformationist, etc.

An alternative perspective to the problem of origin can be raised from **biogenesis** (life arising from non-living matter) and the **"primordial soup"** (Opsin), that is, the combination of elements that gives rise to the synthesis of compounds " organic" after adding energy to the system (from lightning, UVA radiation, volcanic activity, etc.)

6.6.3 On the Environment

6.6.3.1 On the Forces

We do not know the forces (and their sources) that operate driving the process of change in the individuals of a population.

Apart from the forces that operate at the level of individuals, it is necessary to know what the transmission mechanisms are like from the environment to the individual, between individuals, and vice versa, from the individual to the environment.

What is the materiality of the pressure for change exerted by an environmental force?

6.6.3.2 On Selection

One of the most difficult questions that every evolutionary analyst must face is how the **selection process** imposed by the environment actually work, and to what extent different alternative selection approaches can help explain the evolutionary course of the system.

We refer to the selection process not as the blind application of a closed paradigm that we know a priori will provide an explanatory response to the evolution of any system, but rather the analyst evaluates to what degree alternative selection models can provide insight into our understanding of the evolution of the system. It is about better understanding how rival visions can have a place in our understanding of the evolutionary phenomena of the system, even in an open and simultaneous way.

6.6.4 On the Unit

6.6.4.1 On the Structure

6.6.4.2 On the Behavior

To what extent is the system's behavior governed by inherited **instincts**? And to what extent can the selection process alter instincts? Are instincts constraints to the development of behavior and the process of change, or are they not such constraints?

What behavioral traits can be considered **innate** and which are constructed with the interaction with the natural and social environment? What are the environmental stimuli that might help explain the individual instincts?

Perhaps the analyst, in addition to (the above) behavioralist approach, might approach the analysis of the behavior by exploring the internal processes inside the individual that trigger observable responses in the individual.

Can individual behavior be **predicted**? Furthermore, can behavior be controlled by manipulating the environment and creating a stimulus-response association in the individual? The evolutionary analyst might also focus on how the individual learns through the association of stimuli with specific responses.

To what extent can **learning** and **technology** affect instincts to the point of making them heritable?

The problem of **hierarchy** can also affect behavior to the point that the evolutionary analyst can try to elucidate what the behavioral hierarchy is (e.g. intellectual, social, moral, etc.). How are these behavioral faculties created?

It is important for the evolutionary analyst to assess to what extent there is the possibility that we have the ability to **control genes** and, therefore, that we can control how human behavior can be controlled (The Blind Watchmaker- R.Dawkins)

6.6.5 On Change

We know what an individual is today, but we do not know how an individual became what it is today. This necessarily raises the need to study the **historical past** as a source of knowledge to understand the process of change or evolution followed.

If change does not leave any **proof** (of evolution), why don't we seek indirect progress (i.e. the equivalent of fossils)?

It is necessary to know which components of the individual's structure (or flows) the **forces of the environment** act on, or on which behaviors the forces of the environment have an impact.

Also relevant is the question of how the **development process** of an individual is like, both before conception (embryonic development) and during its life period.

Does the change caused by forces in the environment respond to any **goal or objective**? Is there any direction, goal or trend? And if there is one, what is the justification for it to exist? Is there any type of constraint associated with the development of the individual that conditions or limits the process of change? Can we rule out that the individual's process of change does not have a teleological character (e.g. a guiding principle, a force, etc.) towards a specific end/goal?

In the analysis of **evolutionary dynamics**, it is interesting to know if the system becomes stable and in equilibrium, stable and not in equilibrium. Finding out this situation allows us to better understand the nature of the evolutionary process and try to predict the next steps in the evolution of the system.

What are the **change mechanisms** used by units to respond to environmental forces? Some may be:

1) Hybridization
2) Recombination
3) etc.

To what extent is the **timeline** for the adoption of changes a key factor that determines the individual results of the change? When analyzing change it is key therefore key to elucidate the timeline in which it unfolds.

Speaking about the timescale of the change processes, it is interesting to find out if the system is constrained by certain structural limitations, or that they have their origin in its own development, and that explain why the changes occur. This would allow the evolutionary analyst to estimate the particular evolutionary **"clock"** of the system. The idea of the clock is to explain traits that evolve at a constant rate overtime, due to underlying molecular mechanisms. In other words, that would explain the rate of change at which changes accumulate over time.

It is evident that the clock idea would not offer precise information similar to that currently used in the field of molecular biology or genetics to provide insight into the the tempo and mode of evolutionary change, but it could be a qualitative approximation to the temporal factors that intervene in the rate of evolution of a system.

A possible model that explains the evolutionary process that should be seriously taken into account is known as **punctuated equilibria"**. According to this model, species remain relatively stable and in equilibrium with their environment for long periods of time. During this time they register small changes in their morphology or level of adaptation. However, at certain times, sudden changes occur that trigger evolutionary episodes of changes (punctuation) associated with events that are accompanied by speciation. These periods of rapid change would be interspersed with long periods of stasis.

The evolutionary analyst should open to the notion of **arrow of time**, and the preferred direction or sequence of change. And if the change process is reversible vs irreversible (with higher entropy). In turn, this should lead the analyst to consider the predictability or unpredictability of evolution.

Is the result of evolution the same system of a new one?

6.6.6 On Heredity

What are the limits of heredity (change)?

7 Theory

- The concept of evolutionary frameworks in the economics/firm/business literature
- Reviews of framework studies

The following section combines several of these aspects, to provide a 'meta-framework' for evaluating STI frameworks.

7.1 Natural Science as the Cornerstone of Evolutionary Inquiry

The study of evolution in the natural sciences serves as a foundational pillar for understanding evolutionary phenomena across various disciplines due to its fundamental principles and overarching explanatory power. Evolutionary theory, rooted in biology and natural selection, elucidates the mechanisms driving change and adaptation in living organisms over time. These principles extend beyond biology, providing insights into the dynamics of change, adaptation, and innovation in diverse systems, including social, economic, and cultural domains. By examining how species evolve and interact within their environments, evolutionary science offers valuable analogies and frameworks for understanding analogous processes in other disciplines. Consequently, evolutionary concepts serve as a unifying framework, facilitating interdisciplinary research and fostering a deeper understanding of complex phenomena across different fields. Thus, the study of evolution in the natural sciences not only enriches our understanding of biological systems but also provides valuable insights into the dynamics of change and adaptation in broader contexts.

7.2 What is a Framework?

At a general level, in this paper a framework is understood as an abstraction: a type of mental and communicative construct to help build a coherent world view. A framework is not always visible to the user, but a framework for the use of indicators in a decision making context should be designed in a conscious, communicative process (15). Assmuth & Hildén (16) define frameworks as "the conceptual and procedural constructs that assimilate, process, and give meaning to information". This definition highlights two dimensions to help frameworks do precisely this: 1) the 'conceptual' dimension that aims to capture the substance or essence of what is to be measured and elucidated (for example, frameworks to measure 'sustainability' *organized in the Triple Bottom Line (TBL) domains), and 2) the 'procedural' or 'operational' dimension, which refers to more practical concerns – who needs to do what to collect, produce and report the required information? A third important dimension not highlighted by Assmuth and Hilden's definition concerns the purpose of the information, what is termed hereon the 'utilization' function. Cornet and Gudmundsson (2015)*

7.3 What is the purpose of a Meta-Framework?

A meta-framework is understood as an overarching frame for what should inform the analysis and eventually the design of STI practice frameworks, meaning frameworks used by or provided for transportation policy and planning bodies to select and apply indicators for sustainable transportation. The meta-framework is not a general theory, nor a master framework to be adopted directly by agencies, but a classification and evaluation device. It should, above all, allow for a structuring of the empirical analysis of frameworks adopted by agencies in practice. Such analysis will review how the conceptual, operational and utilization functions of a case framework are performed, and how the most important criteria for each function are fulfilled. These criteria should allow a comprehensive analysis of the strengths and weaknesses of different practical frameworks with regard to how well they manage to connect sustainability theory to action.@cornet2015building

8 Conclusion

The evolutionary analysis of systems fundamentally requires generating much more extensive and precise knowledge about individuals and populations, as well as about the periods and places in which they develop. This is self-evident when it comes to obtaining a deeper understanding of the reasons for change and diversity.

We also know today that systems do not evolve smoothly and continuously over long periods of time but do so based on pulses between periods of interruption that cause disruptive changes and the mass extinction of units.

Knowing the sequence of events that have shaped the evolutionary processes opens new analytical dimensions to the study of the evolutionary phenomenon and allows us to confront elements considered unpredictable until now in the course of evolution.

It is certainly an exciting time for the field with the rapid expansion of science and practice. However, this growth has put positive education at risk of lacking a cohesive direction and of failing to build the cumulative evidence needed to advance the field.@waters2019search

In this paper we have argued that a meta-framework can prevent these risks by providing higher-order parameters that help us to guide future research and practise in ways that ensure more consistent, integrated, cohesive and perhaps even synergistic outcomes. The SEARCH framework, developed from a large-scale bibliometric analysis of the field combined with action research has been supported through a systematic review of evidence in the current paper which has shown that schools can build up each of the six pathways through interventions in and out of the classroom.@waters2019search

We offer this framework to our colleagues in the field and hope it is used far and wide to build rigorous research and reliable practices that help positive education to achieve the dual purpose put forward by Seligman et al. (2009) of boosting wellbeing and academic outcomes.@waters2019search

This review of involving the public in research agenda setting builds on the technique of framework analysis which has previously been described only for primary research.6 We found this approach useful for developing a conceptual framework of public involvement in research based on accessing and reviewing a broad literature. Our framework is consistent with analyses in the literature about empowerment for public involvement in public services more broadly. It is potentially applicable to a wide range of reports of public involvement in research and research-based activities. Use of the framework facilitates learning from many different strategies and reports of these, from informal reflections to formal research. Such a breadth can thus *generate an overview of achievements to inform policies and practices in the area of public involvement in research. As with other systematic review methods, application of the framework also usefully identifies gaps in the literature which need to be filled in order to increase our understanding of how to promote public involvement and evaluate the effectiveness of different approaches.@oliver2008multidimensional*

8.1 Recommendations

We need more good quality research on interventions for particular social groups. Nonetheless, it is possible to derive a number of recommendations from the work described in this report. They are grouped into recommendations for developing future effective and appropriate interventions, systematic reviews, and views studies.@brunton2006synthesis

Type of recommendations: Recommendations for developing effective and appropriate interventions / Recommendations for future views studies / Recommendations for future systematic reviews. Brunton et al. (2006) The

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