

## The Artificial Life-Form as Entrepreneur: Synthetic Organism-Enterprises and the Reconceptualization of Business

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### Extended Abstract

In this work we demonstrate the theoretical possibility and explore the implications of developing artificial life that functions as an autonomous business within the real-world human economy. By drawing on the Viable Systems Approach (VSA), we introduce the new concept of an “organism-enterprise” that exists simultaneously as both a life-form and a business. We then reconceptualize the anthropocentric understanding of a “business” in a way that allows an artificial life-form to constitute a “synthetic” organism-enterprise (SOE) just as a human being functioning as a sole proprietor constitutes a “natural” organism-enterprise. Practical obstacles to the creation of SOEs are considered, along with possible means of surmounting them. SOEs would move a step beyond current examples of artificial life that produce goods or services within a simulated world or play a limited role within a human business: rather than competing against artificial organisms in a virtual world, SOEs could evolve through competition against human businesses in the real-world economy. We consider concrete examples of SOEs and conclude by highlighting legal, economic, and ethical issues that arise when a single economic ecosystem is shared by competing human and artificial life.

**The concept of an “organism-enterprise.”** A business is defined as “the organized effort ... to produce and sell, for a profit, the goods and services that satisfy society’s needs” (Pride, et al. 2014). Management theorists have drawn on biology to better understand the structure and function of such business organizations. Our research utilizes a systems theory grounded in neurophysiology, the Viable Systems Approach (VSA), that allows us to understand a business as an autopoietic organism or “system” that dwells within the ecosystem of a larger economy or “suprasystem” (Beer, 1981; Barile, et al. 2012). Within this ecosystem, a business must compete against other organisms for limited resources and adapt to environmental demands. In our human economy, individual businesses are born, grow, and die, and taken as a whole, this array of businesses forms an evolvable system.

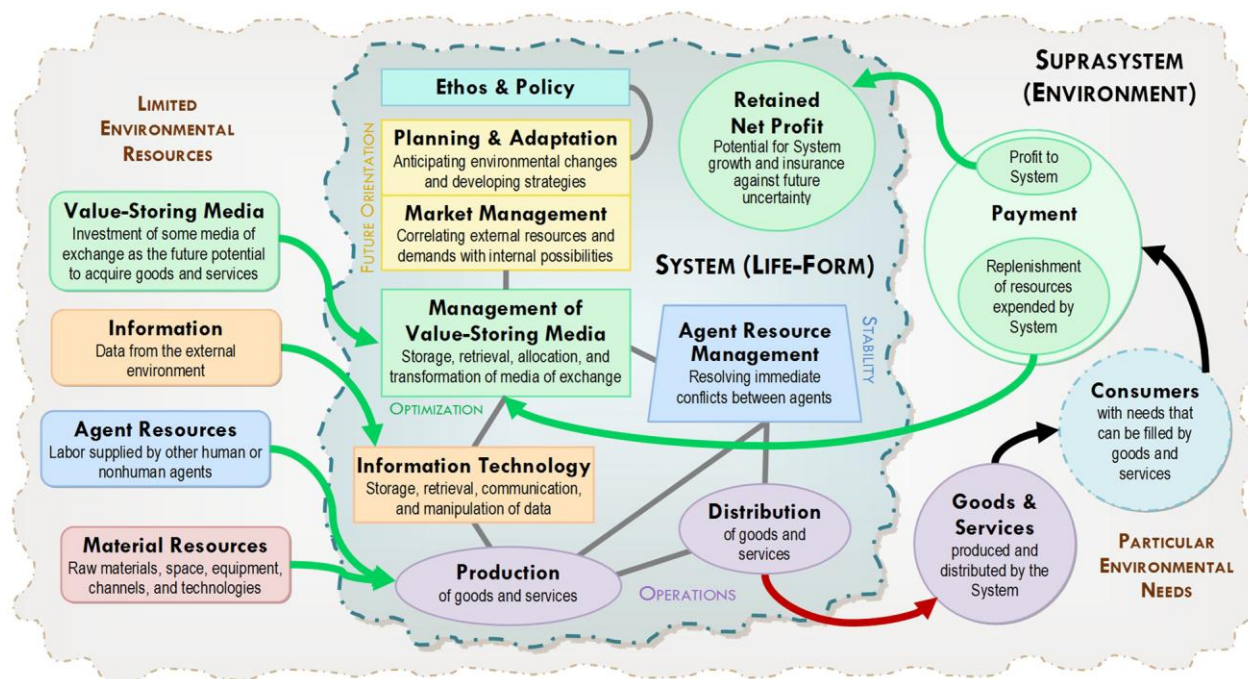
We begin by considering one unique instance in which a business is not simply “analogous to” a living organism, but identical to it: namely, the case of a human being who functions as a sole proprietor. In this situation, a single system simultaneously satisfies all the requirements of being both a life-form and a business. Building on this case, we introduce the idea of a unitary “organism-enterprise,” a concept that is already instantiated in the form of at least 20 million “human organism-enterprises” within the United States alone.

**Reconceptualizing business to include synthetic organism-enterprises.** Utilizing VSA and the concept of an organism-enterprise, we analyze the traditional anthropocentric understanding of business as an exclusively human activity to consider whether an artificial life-form could serve as a “synthetic organism-enterprise” (SOE) that is both a life-form and a business. We show that this is indeed possible, but requires us to transform our understanding of business.

For example, human businesses are traditionally described as requiring four kinds of resources: 1) human; 2) material; 3) financial; and 4) information. To replace this anthropocentric understanding, we propose that a business be understood more generally as requiring: 1) agent resources; 2) material resources; 3) value-storing media; and 4) information. Similarly, a human business requires functional units filling roles in production, finance, marketing, human capital management, and information technology. Drawing on VSA and the case of a human sole proprietor, we consider the ways in which these functions can be understood more generically, in such a way that they can also be performed by current and proposed forms of artificial life. We give particular attention to the role of “profit” in a human business and formulate an account of its correlate for an SOE: it is the difference between resources expended and received in exchanges in the suprasystem that provides an SOE with a potential for growth and insurance against environmental uncertainties.

Figure 1 provides an overview of our reconceptualized “business process cycle,” which can be carried out equally well by either a human business or an artificial life-form that has been designed or evolved to fill a business role within a larger economic ecosystem.

**Current obstacles to an artificial life-form as organism-enterprise.** Artificial life-forms have already been designed that are capable of carrying out this entire business process cycle within the simulated ecosystem of a virtual world (Kubera, et al. 2011). Similarly, there are artificial life-forms capable of carrying out parts of this cycle within human businesses in the economy of the “real world” (Kim and Cho, 2006). However, our survey of the field has not yet identified any existing artificial life-forms capable of carrying out this entire business process cycle within the real-world human economy. We identify a number of obstacles that currently prevent this from taking place, and we highlight those areas within the business process cycle that pose the greatest challenge for the future development of SOEs.



**Figure 1.** A reconceptualized business process cycle that applies to a human organism-enterprise as well as to a synthetic organism-enterprise (SOE) that has been designed or evolved to provide goods or services within some ecosystem.

**Designing artificial life-forms that can complete the business process cycle.** We briefly consider some approaches to overcoming these obstacles, so that an artificial life-form can not only meet the minimal requirements for constituting a synthetic organism-enterprise but potentially even excel in the role of entrepreneur (Ihrig, 2012). We especially consider the potential of virtual goods and cryptocurrencies to overcome the difficulty of providing an SOE with an effective means of utilizing value-storing media (Scarle, et al. 2012).

**Evolution of artificial life through competition in the human economy.** An SOE producing goods or services of value to human beings would be capable of competing against human businesses in the real-world economy. We consider whether these competitive pressures would be sufficient to drive evolution among SOEs. By utilizing the concept of “clockspeed” as a measure of the speed at which businesses must adapt and compete, we identify industries in which SOEs would likely evolve at an accelerated rate (Fine, 1998).

**Specific examples and practical implications of artificial life as entrepreneur.** An autonomous artificial life-form that is capable of securing all of the resources needed for survival and growth directly from the real-world human economy would in principle no longer be dependent on its human designer. Such possibilities are not risk-free: we imagine the case of computer viruses that are capable of evolving self-adaptive behavior rather than mere polymorphism or metamorphism (Beckmann, et al. 2009) and that no longer steal for the financial gain of human cybercriminals but to provide resources for their own survival, growth, and autonomously chosen pursuits. We also consider more optimistic cases, such as the development of artificial life-forms that build successful “careers” as artists or composers

or IT service-providers within the human economy and that are able to evolve in response to economic demands, without the active guidance or support of a human designer. Finally, we propose areas for future research to address the moral, legal, and economic issues that will arise from the existence of synthetic organism-enterprises and the fact that the productive and competitive capacities of successful SOEs could far surpass those of traditional human businesses.

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