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Social Enterprise Systems Engineering

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Abstract

This conceptual article advances a theory of Social-Enterprise Systems-Engineering (SESE) as an applied discipline and as an addition to the development intervention field. It will elaborate the SESE construct, examine the relationships between its constituent components, present evidence of its potential benefits and then provide suggestions for future research.

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1. Overview

This conceptual article advances a theory of Social-Enterprise Systems-Engineering (SESE) as an applied discipline and addition to the development intervention field. It will elaborate the SESE construct, examine the relationships between its constituent components, examine evidence of its potential benefits and then provide suggestions for future research. Its approach draws from Lynham's [1] Conceptualize and Operationalize phases.

The structure of this article and its approach to validating 'Social Enterprise Systems Engineering' as a theory and disciplinary construct is based upon David Whetten's 1989 Article "What Constitutes a Theoretical Contribution?" [2]. It also draws upon Lynham [1], and Swanson and Chermack's work on theory building in applied disciplines [3, 4]. Because of this article's reliance upon Whetten's guidelines as a template, a brief examination of that article's bona fides is provided. Written while the author was an editor of the 'Academy of Management Review', Whetten's purpose was to provide structure and guidance for authors submitting theoretical and conceptual papers. His article is highly cited and has retained its relevance. It has been cited 1,662-times since its publication, 762-times since 2010, 301-times since 2013 and 152-times between January and November of 2014 [5]. This article is divided into sections based upon selected questions from the Whetten article. It also employs perspectives and methods from Swanson and Chermack—as outlined in Table-1 (below).

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Table 1 Article Structure based upon Whetten, 1989 and Swanson & Chermack, 2007; 2013

Section	Whitten context	Swanson & Chermack context
1. Overview		
2. What	The factors, variables and concepts	Define the concepts & boundaries
3. How	How are the factors related?	Organize the concepts
4. Why	The dynamics that justify the selected factors	Inputs to the “Conceptualize” phase
5. What and How	Models for deriving testable propositions	Operationalize: describe transferable propositions
6. Limitation and future Research		
7. Conclusions		

2. What is Social Enterprise Systems Engineering?

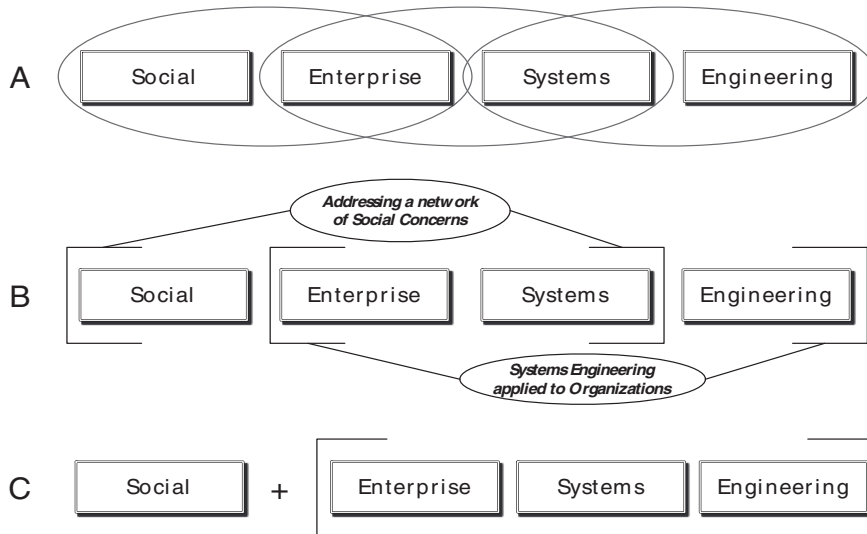


Figure 1 Venn analysis of Social Enterprise Systems Engineering

Figure 1 contains a Venn analysis depicting Social Enterprise Systems Engineering (SESE) from three perspectives. This analytical approach is consistent with research into the use of Venn analysis to facilitate conceptual understanding in instructional programs related to interdisciplinary subject matter [6]. Perspective ‘A’ depicts SESE as three distinct disciplines Social Entrepreneurship², Enterprise Systems and Systems Engineering. Perspective B depicts two disciplines, ‘Social Enterprise Systems’ and ‘Enterprise Systems Engineering’. Perspective C is intended to indicate ‘Enterprise Systems Engineering’ bound to a non-discretionary ‘social’ objective. The Venn analysis highlights SESE’s component disciplines, the relevance of which are explained below.

² The term ‘Social Enterprise’ appears in the academic literature in several contexts. It is sometimes taken to indicate charitable mean non-profit organizations that rely on donor contributions. It is also used to describe organizations created and managed by social entrepreneurs – intended serve a social purpose through their business processes and self generated revenue. The term ‘Social Enterprise’ as used within this article is limited this second meaning. In every instance it is intended to indicate organizations that serve a social purpose through their business processes and self generated revenue – or organizations created and operating for the purpose of social entrepreneurship. Throughout this article the terms social enterprise and social entrepreneurship are used interchangeably to indicate the same phenomena. They represent the noun (an organization) and verb (the act of social entrepreneurship) perspectives respectively.

As a disciplinary construct, Social Enterprise Systems Engineering integrates three of society's emergent paradigms for developing solutions to complex problems.

- The systemic study of the factors and the mechanism that assure the design and performance of large-scale solution as 'systems' is the traditional province of **Systems Engineering**.
- **Social Entrepreneurship** [7] has roots in business, management studies, and social systems theory [8]. The study of all manner of value propositions is traditionally the province of business and management research (strategic management, marketing, supply chain, operations research, organization behavior). Social Entrepreneurship adds an additional level of complexity -- a non-discretionary requirement to create social value [9-13].
- **Enterprise Systems**, an emergent field within systems engineering, examines organizational phenomena from an integrative 'systems' perspective -- across business and management disciplinary boundaries. It gives specific focus to the extended enterprise and issues of scale and governance in multi-stakeholder systems [14]. Where business and management research would typically examine phenomena within sub disciplinary frameworks (marketing, finance, supply-chain, accounting, organization behavior, strategy) enterprise systems engineering tends to be more integrative and examines issues of design, implementation and operations across all of these disciplines. It is particularly relevant where there are issues of scale and complexity.

Integrating these disciplines -- as social enterprise systems engineering -- answers the call for scale, design innovation, and solution assurance found in the social enterprise literature [15-17]. It also addresses the long unanswered call for systems engineering research to address societal and social issues [18-21]. With the emergent field of enterprise systems acting as the pivotal bridge between social enterprise and systems engineering, the SESE construct provides a framework for the integration of business & management, entrepreneurship, systems engineering and social exchange theory [22] as a platform for disciplined collaboration across these domain -- thereby supporting the crafting and execution of solutions to some of the worlds more confounding social problems. Given the pivotal role of enterprise systems, within the SESE construct, a rich definition is provided below, synthesized from Liles et al, Dietz and J. Hoogervorst, Rouse, Lawson and Giachetti [23]. It is intended to clarify the scope and relevance of enterprise-systems as an essential component of this approach.

Enterprise Systems Engineering is that body of knowledge, principles, and practices having to do with the analysis, design, implementation and operation of an enterprise, where 'enterprise' is defined as an intentionally created cooperative of human beings with a certain societal purpose. A defining tenet is the assertion that the enterprise should be viewed as a system, therefore, in order to more robustly analyze and evaluate the enterprise holistically; standard business management methods are augmented with the tools and methods from the systems engineering discipline. Unlike traditional systems engineering however, the enterprise-systems approach incorporates people as a component of the system -- not merely as a user or operator of the system. The inclusion of people -- as both a system component and stakeholder -- means that the enterprise must be viewed as an adaptive agent, capable of learning and producing emergent behaviours. Accordingly, 'design' does not occur at a single point in time as is typical of product-oriented systems. Instead, enterprise-systems sense, respond and adapt over time -- or are continually undergoing design.

Delving a little deeper, Figure 2 (below) uses Swanson and Chermack's "Theory Framework for Applied Disciplines" [4] to illustrate a set of contributing theoretical constructs that facilitate the three 'core disciplines' (Social Entrepreneurship, Enterprise Systems and Systems Engineering) depicted in Figure 1: Perspective 'A' (above). As shall be demonstrated in a subsequent section, the core concepts from Norman Long's Actor-oriented Social Constructivism [24, 25]: (Social Actors, Organizing Processes, Knowledge Processes, Power Configurations, Social Interface, Agency, Networks and Activity Theory) included in Figure 2 as facilitating processes, are readily accommodated into the systems engineering V-model -- to produce a coherent lifecycle process appropriate to the design and implementation of a social enterprise system as a development intervention.

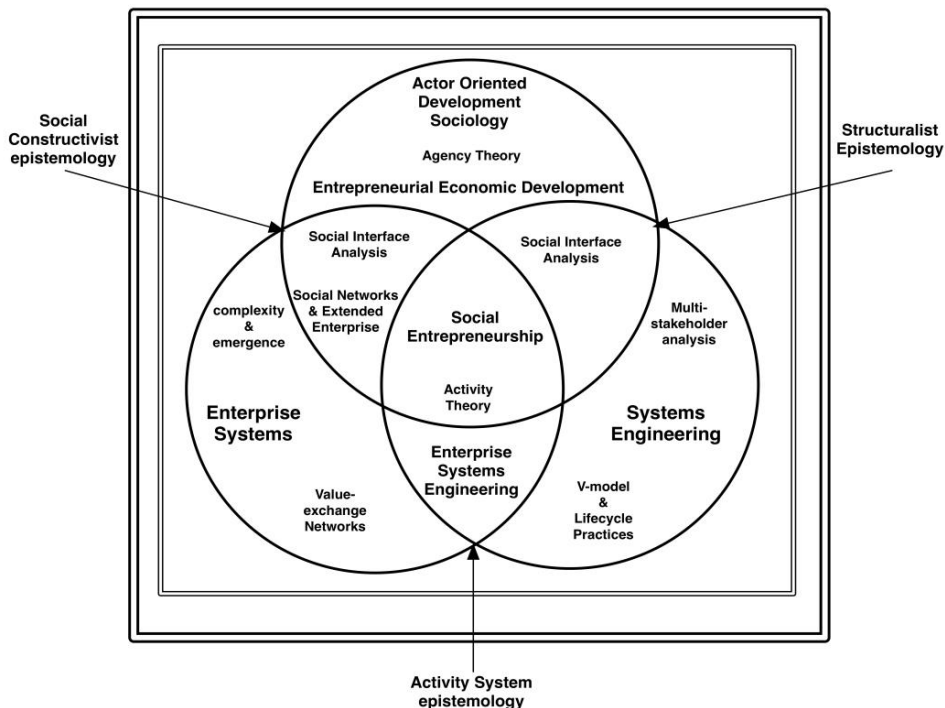


Figure 2 The Swanson and Chermack Analysis³

3. How are these factors related?

Consistent with Whetten’s guidelines, Figure 3 (below) and the language in this section provide an elaboration of the relationships between the elements introduced in section two. Key aspects of social entrepreneurship, enterprise systems, and systems engineering are decomposed and their relationships are visually and verbally explicated. Figure 3 is itself an expansion of the diagram produced by Saenz et al in their 2009 article “Defining Enterprise Systems Engineering” [26] (see Figure 1 page 496). As in Saenz et al, the meanings of the terms social entrepreneurship, enterprise, system, and engineering -- and relationships among them -- are identified visually and elaborated in accompanying language. This org-chart style approach is also consistent with the analysis utilized in the ‘Organize the Concepts’ phase of Swanson and Chermack’s methodology for “Theory Building in Applied Disciplines”[3] (see pages 66-67). The language that follows below is based upon a verbal elaboration of the image in Figure 3.

Social Enterprise Systems Engineering (SESE) is defined as that body of knowledge and practice whereby engineering discipline is applied to plan, analyze, design, implement and operate a coordinated network of enterprises processes and stakeholders – in order to create sustainable social value for marginalized populations. Engineering discipline brings the rigor of lifecycle process, verification, validation, non-functional requirements modeling and simulation to assure that the design and performance of solutions are driven by and are traceable to the requirements of stakeholder populations – and that opportunity selection and operational practices align with the social mission and values of the enterprise.

³ Also see Figure 4 and Section 5 (below) for the realization of the constructivist, structuralist and activity system epistemologies in a V-model.

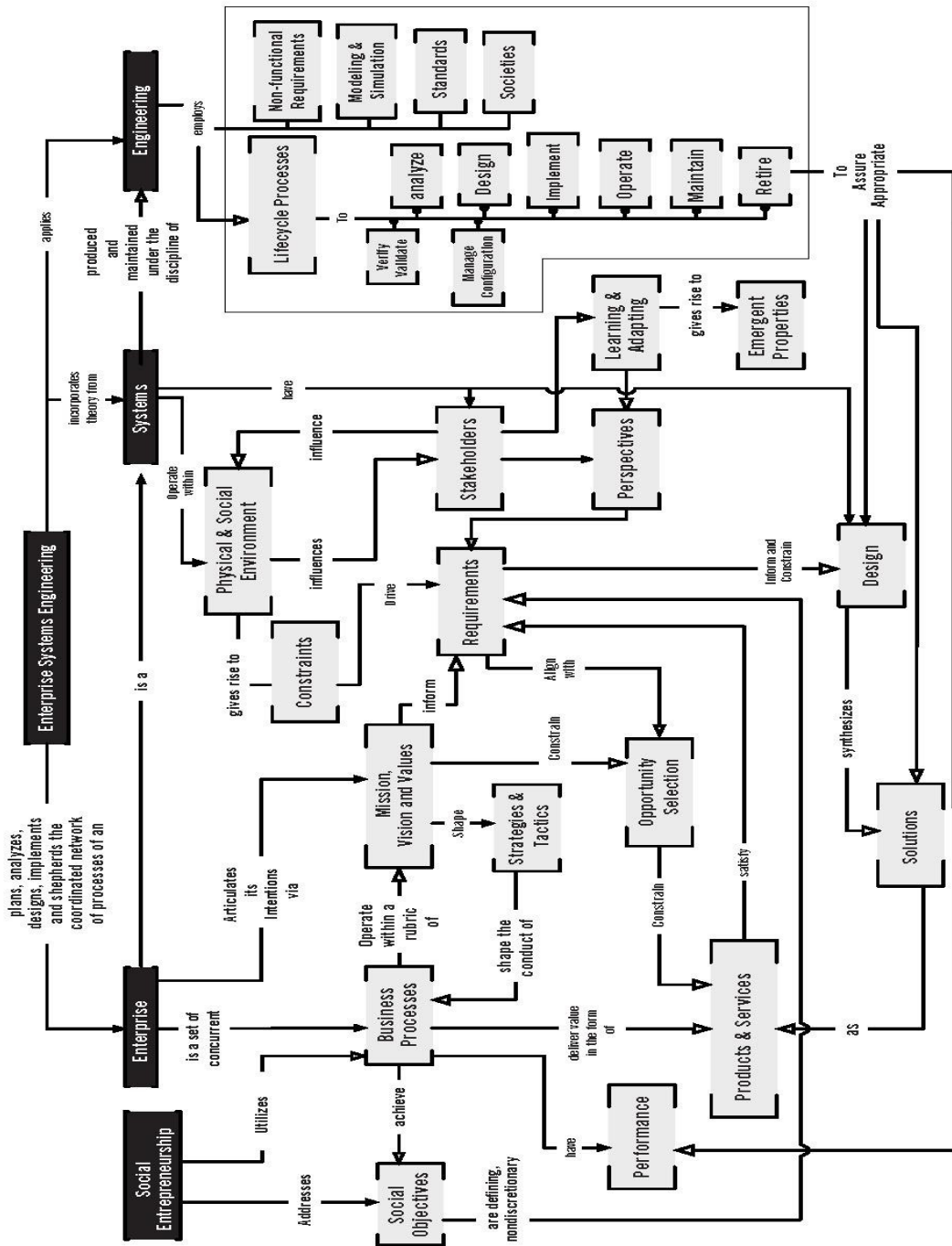


Figure 3 Conceptual Relationships Among SESE Components

The engineered social-enterprise system is simultaneous a social-actor, an organizing process and a sense making activity [24, 25]. Its object is to produce an activity system in a power-configuration crafted to increase the agency of one or more social actors. It instantiates an adaptive agent (the enterprise system) as a development intervention – encapsulating mission, vision, requirements, operational-processes, structure, roles and responsibilities – all linked to specific stakeholder populations and implemented under rigorous verification and validation protocols.

4. Why? Understanding the underlying dynamics that justify the selection of factors.

Why is a new approach or addition to the field of development intervention needed? There is a good deal of evidence highlighting the shortcomings of those bodies of practice intended to develop and assure the wellbeing and quality of life of diverse at un-empowered populations. For example, noting that “Human deprivation and suffering around the world are increasing despite the efforts of traditional aid-based approaches focused on alleviating poverty and improving the quality of life for marginalized communities”, Dzombak et al [27]” present an argument for “The Relevance of Systems Thinking in the Quest for Multifinal Social Enterprises”. Jeffrey Sachs states that more than eight million people die each year because they are “simply too poor to live” [28]. Prahalad’s benchmark is that more than four Billion people live on less than two U.S. dollars per day [29] and that two thirds of the earth’s population live in poverty [30]. Hart [31], notes that between 1960 and 2010, the gap between the world’s poorest and richest quintiles grew from 30:1 to 80:1. The inescapable fact is that the combined outputs of all active bodies of practice associated with redressing these issues have been unequal to the task. This alone is ample justification for investigating new paradigms.

The next question is why this particular set of practices should be considered. Why should the viability of ‘Social Enterprise Systems Engineering’ be researched? Although social entrepreneurship has proven to be a useful addition to the field of development intervention[32, 33], thus far it does not scale well and there are questions about our ability to reliably assess the viability of early stage business models and implementations. Bloom, has researched and written extensively on the issue of increasing the scale and impact of social entrepreneurship [16]. With regard to the need for rigorous planning, design and assessment, MacMillan and Thompson have developed a series of case studies which they have packaged with some methodology suggestions as a ‘playbook’ [17] for ‘pressure testing’, planning, launching and scaling a social enterprise. Also in the area of measurement, Lane has attempted to codify a framework for assessing the performance of a social entrepreneurship ventures [34]. This research demonstrates an awareness of the need to address these limitations. That said, and as laudable as these efforts are, when contrasted to the work of standards committees in an engineering society, the current body of social entrepreneurship research has produced individual pockets of stand-alone models developed under informal consensus and unconnected to a codified body of knowledge. Furthermore, many of the issues that have been addressed with stand-alone ‘one-off’ frameworks -- managing scale, design trade-spaces, process rigor and quantitative performance evaluation -- are among systems engineering’s strengths. I argue that many of issues and limitation openly discussed in the development intervention and social entrepreneurship research agendas can and have been addressed by tools and techniques embedded in the Social Enterprise Systems Engineering construct.

The application of engineering rigor and practices and an enterprise systems perspective are new additions to both social entrepreneurship and development intervention. That said, there is ample empirical evidence of the benefits accrued to applying the engineering body of practice across diverse domains. Although much of it stems from the software systems engineering domain, there is good evidence [35] that the application of systems engineering becomes increasingly critical as the scale and complexity of an endeavor under management increases.

Systems engineering brings a raft of tools and techniques for managing complex, interdisciplinary large-scale, multi-stakeholder programs. It has become progressively integrated into a range of domains where a solution-driven orientation has led to the integration of multiple disciplines, or where complexity and the need for a holistic systems approach has emerged. The emergence of enterprise systems engineering is itself an example of this. Its inclusion offers solutions to significant open issues in the social entrepreneurship and development intervention research agendas. It also extends the systems engineering field into the interdisciplinary social science of development intervention.

Contemporary development intervention programs embody this type of complexity as well as a requirement for the integration of multiple disciplines. For example, the program to address the eight Millennium Development Goals (MDGs), which range from halving extreme poverty rates to halting the spread of HIV/AIDS, building roads and infrastructure and providing universal primary education [36] -- over a global footprint -- is an example of the scale, scope and complexity of a major contemporary development intervention. In spite of this scale, scope and complexity -- and systems engineering's well document affiliation with mitigating these risks -- the author was unable to find any evidence of the participation of systems engineers in the design, implementation or on-going assessment of the program. The lack of adoption of a tool that has proven itself to be beneficial under similar circumstances within other domains is also reason enough to open a line of inquiry.

Both 'social entrepreneurship' and 'systems engineering' have proven themselves to be important contributions in their respective fields. Positioning 'enterprise systems' as a bridging discipline in the 'social enterprise systems engineering' construct, places systems engineering capabilities -- as elaborated in the definition of 'enterprise systems engineering' in Section 2 (above) -- in alignment with social entrepreneurship and development intervention perspectives. It also holds the promise of achieving interventions at a scale and complexity that has largely eluded the social entrepreneurship paradigm. While large scale social enterprise do exist [37], they are the rare exception. At the other end of the spectrum, many development interventions address single factors such as clean water, primary education, sanitation or healthcare. These single-factor-programs fail to holistically address quality of life and leave the redress of vital issues to chance. Clearly, this domain would benefit from a codified body of knowledge and a repeatable, reliable, scalable and rigorously tested body of practice that supports the management of interdisciplinary programs. These attributes are among the strengths of an engineering approach. This is why research to examine the viability of the social enterprise systems engineering construct holds merit -- and why there is ample justification for combining these components into a single disciplinary construct. Finally, research conducted under the umbrella of this type of interdisciplinary construct would serve to expand the scope of the body of practitioners focused on development intervention solutions.

5. The combination of what and how. A Social Enterprise Systems Engineering V-model

This section will diverge somewhat from the precise methodology described by Whetten. Noting that "Not all bona fide theoretical contributions require propositions", Whetten stipulates, "when the purpose of a paper is to present a new theoretical position [...] researchable propositions are very useful. They force the author to think about the concrete application of new or revised thinking." The approach used to address this issue in this section this article is to provide an example of a concrete application with broad utility by combining the 'what' and 'how' of "social enterprise systems engineering" into an instance of a V-model [38, 39] that might be used to elaborate and validate a 'social enterprise system' architecture. Elaborating and validating an enterprise systems architecture is a broadly recognized methodology [40-45] and essential lifecycle stage for designing, transforming or developing an understanding of the capabilities of a given system configuration.

Figure 4 (below) illustrates a V-model [38, 39] -- appropriate to elaborate and validate a social enterprise system architecture. It integrates elements drawn from the theoretical frameworks arrayed in Figure 2 (above). As illustrated in Figure 2, this approach to 'social-enterprise-systems-analysis' is theoretically grounded in actor-based development sociology [24, 25], enterprise systems and systems engineering methodologies. Executing the process of enterprise-systems analysis as depicted in Figure 4, is itself an activity-theoretic [46, 47] exercise in sensemaking and agency building, which serves as an outlet for social actors to configure and validate a new and beneficial social interface -- modeled as an enterprise-system-architecture. The enterprise system is itself simultaneously a social-actor; an organizing process and a knowledge (sensemaking) process. As a social entrepreneurship business process design exercise, the objective is to shepherd the emergence of a new power-configuration -- intended to increase the agency of two or more social actors. Engineering an enterprise system as a development intervention instantiates an adaptive agent (the enterprise system) encapsulating, mission, vision, requirements, process, structure and roles & responsibilities -- all linked to specific stakeholder populations, and implemented under rigorous verification and validation protocols (see Figure 4).

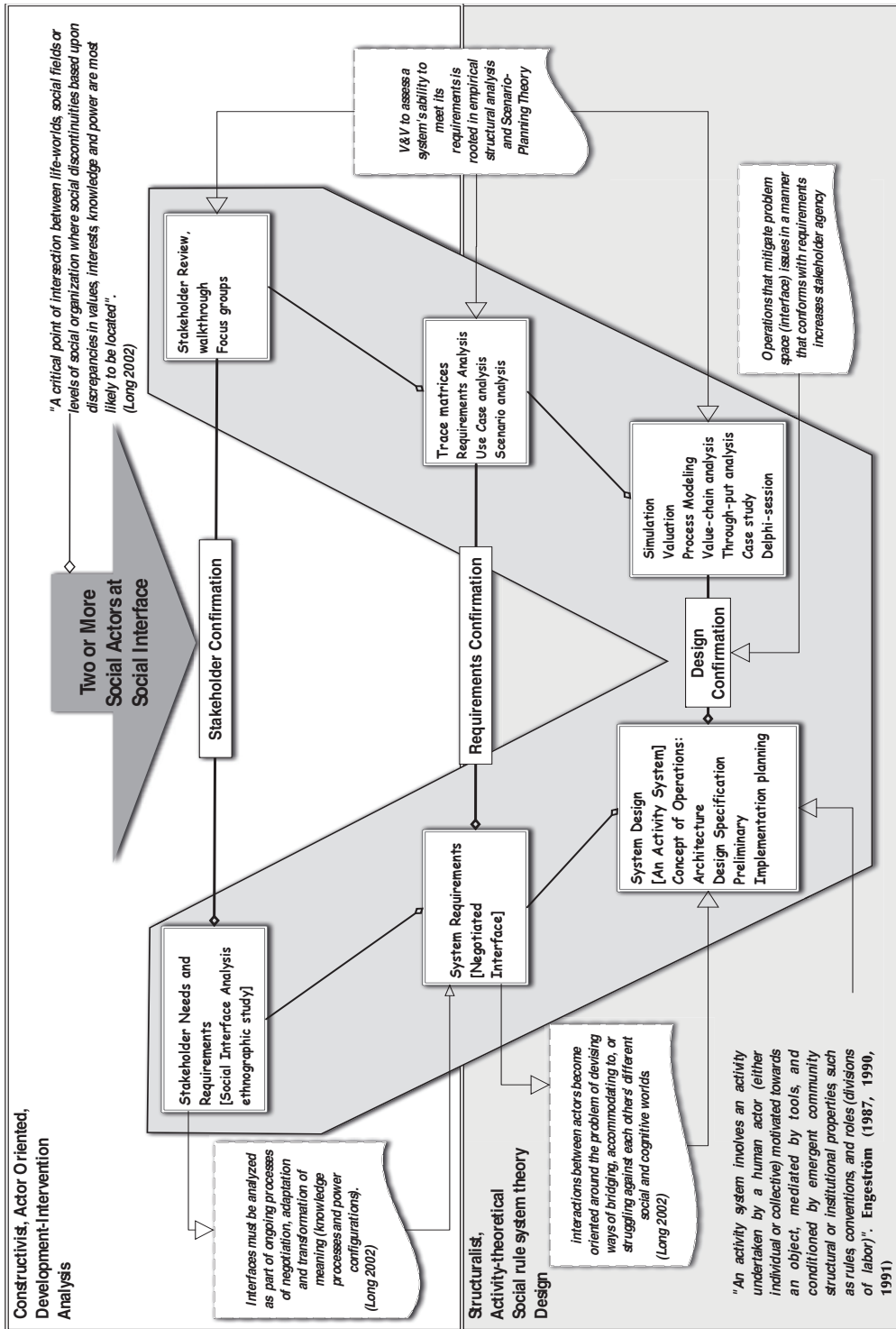


Figure 4 A Development Intervention V-model

As a systems engineering exercise, traversing the V-model progressively surfaces, elaborates & affirms:

- **New knowledge** via the social interface analysis that produces and analyzes stakeholder requirements;
- **Roles and activities**, through which stakeholders can exchange value and increase their agency
- **A system-design (structure)** consisting of networks, resources, value propositions and value exchange relationships, -- disciplined by the constraints imposed by
- **System boundaries**, resource allocation protocols and performance management systems, which serve to channel emergence in alignment with requirements.

Using a V-model approach to develop a social-enterprise-system architecture provides a framework for social actors to engage in the intentional and disciplined construction of a development-intervention – and to test their assumptions about their system’s design. It is a rational, repeatable approach for applying the lifecycle to the creation and management of socially cohesive [48-51] development-interventions -- specific to identified stakeholder-populations and their requirements. It empowers two or more resource-complimentary social-actors to specify, design, implement and manage a structure for their collaboration in a manner that mitigates attributes of their individual problem-space (interface), thereby increasing their agency.

The bottom half of the Figure 4 V-model [23-25] is characterized as “Structural activity-theoretic design”. This equates to System Engineering’s System Definition processes, which includes the activities and artifacts associated with System Analysis [52], Logical Architecture Design [53] and Physical Architecture Design [54]. These processes, sub processes and artifacts are the means by which Systems Requirements are realized as a structured ‘activity system’ (enterprise-system design).

A complimentary relationship between Systems Engineering’s System-Design and Long’s “Interface as an Organized Entity of Interlocking Relationships and Intentionalities” [55] is apparent. This relationship has particular utility for designing an Enterprise Systems as a development intervention. As suggested in the Enterprise System definition provided in Section 2 (above), identifying specific actors and their roles and responsibilities are integral to the system design [23]. This is “structured intentionality” in the form of an architectural-level “roles and responsibilities” template [40-43] -- the rationalization for which is traceable to and embedded in stakeholder requirements. This process provides a means of characterizing & validating the interaction between groups of social actors -- and provides a foundation for assessing the extent to which the structure of a specific ‘roles and responsibilities architecture might impact the agency of its constituent stakeholders. Simulating the behaviour of and enterprise architecture is virtually unheard of in ‘standard’ business and management research – the field that currently dominates social entrepreneurship research. It is, however, widely used within enterprise and systems engineering as a means of analyzing the complex trade spaces [56] produced by the myriad factors that impact the enterprise system’s ability to satisfy its various stakeholder populations [44]. It is also worth noting that this approach can engage stakeholders in the process of co-creating a detail rich intervention in an adaptable, virtual environment -- without incurring implementation risk.

Figure 4 illustrates a single robust methodology proposal. It integrates the methods and disciplines introduced in Section 2 Figure 2, by positioning those methods and disciplines in a broadly accepted approach (V-model) for developing (enterprise) systems. It beneficially positions that collective ‘methodology-set’ in a disciplinary paradigm where it has never been used before (development intervention & social entrepreneurship). Elaborating and validating an enterprise system’s architecture might be considered a comprehensive form of business or mission analysis [57]. The development-intervention mission-analysis V-model for elaborating and validating an enterprise system architecture is offered here as one example of a very rich testable propositions that might be derived from the ‘social enterprise systems engineering’ construct. It is robust and rooted in mature methodology, yet represents only one of many possible methodological frameworks that might be derived from a social enterprise systems engineering construct – and usefully applied to advance the development intervention body of knowledge.

6. Limitations and future research

Social Enterprise Systems Engineering has broad utility, but there are some clear limitations. It is not for projects that are small and simple. It is also not for the ‘quick and dirty’ trial. The evidence cited in Section 4 [35] from “The

Economic Value of Systems Engineering” supports the view that system engineering’s utility appears to decrease as the size and complexity of an effort under management decreases. This is one clear example of a limitation. Regarding future research, there is an enormous body of practice and field of action research made possible by the social enterprise systems engineering construct. Due to space limitations, the list below provides a very a small sample.

- Use the elaboration and validation of enterprise system architecture as a template for organizing subsystem specialists, such as integrating designers of low cost housing, clean water programs and medical service providers into a comprehensive community systems intervention.
- Study of the efficacy of interdisciplinary design teams in contrast to traditional social entrepreneurship research, which is rife with the examination of the heroic individual (the entrepreneur).
- The use of organization simulation to test the ‘portability’ of various social enterprise system concepts. An enterprise architecture simulation of a generalized social enterprise model might be used to calibrate and assess nuances in stakeholder perspectives across diverse cultural sensibilities (Peruvian shepherds versus Vietnamese farmers) prior to implementation.

7. Conclusions

This article makes a case for advancing a theory of social enterprise systems engineering as a development intervention paradigm -- by providing evidence and arguments supporting the following assertions. Systems engineering has codified a rich body of activities, methods and modeling techniques for rigorously eliciting, elaborating and validating appropriate lifecycle artifacts. Systems Engineering techniques and artifacts are compatible with and capable of providing a repeatable and disciplined approach to applying key aspect of Long’s actor oriented approach to development sociology. Both systems engineering and actor oriented development sociology can be integrated into an enterprise systems engineering framework in support of a social entrepreneurship paradigm -- where “interactions between social actors become oriented around the problem of devising ways of bridging, accommodating to, or struggling against each others’ different social and cognitive worlds” [24]. Examples of this include: Long’s actor-oriented social-constructivist analysis (see top half of figure-4); and, commonalities among System Engineering’s **Stakeholder Needs and Requirements** [58], Long’s Ethnographic Study of Social Interface analysis [25, 59, 60] and System Engineering’s **System Requirements** [61] and the mandate that each of these must, traceably satisfy stakeholder needs and requirements [58]. Collectively these satisfy the spirit and scope of Long’s knowledge processes and power configurations as a negotiated activity to define a new interface among social actors [25, 59, 60]. It thereby expands the scope and benefits of systems engineering into development sociology, social entrepreneurship and development intervention.

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