EVALUATING SYSTEM PERFORMANCE IN A COMPLEX AND DYNMAIC ENVIRONMENT

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(ABSTRACT)

Realistically, organizational and/or system efficiency performance is dynamic, non-linear, and a function of multiple interactions in production. However, in the efficiency literature, system performance is frequently evaluated considering linear combinations of the input/output variables, without explicitly taking into account the interactions and feedback mechanisms that explain the causes of efficiency behavior, the dynamic nature of production, and non-linear combinations of the input/output variables. Consequently, policy decisions based on these results may be sub-optimized because the non-linear relationships among variables, causal relationships, and feedback mechanisms are ignored.

This research takes the initial steps of evaluating system efficiency performance in a dynamic environment, by relating the factors that effect system efficiency performance to the policies that govern it. First, this research extends the concepts of the static production axioms into a dynamic realm, where inputs are not instantaneously converted into outputs. The relationships of these new dynamic production axioms to the basic behaviors associated with system dynamics structures are explored.

Second, this research introduces a methodological approach that combines system dynamics modeling with the measurement of productive efficiency. System dynamics is a modeling paradigm that evaluates system policies by exploring the causal relationships of the important elements within the system. This paradigm is coupled with the fundamental assumptions of production theory in order to evaluate the productive efficiency of a production system operating within a dynamic and non-linear environment. As a result, a subsystem within the system dynamics model is introduced that computes efficiency scores based on the fundamental notions of productive efficiency. The framework's ability to combine prescriptive

and descriptive modeling characteristics, as well as dynamic and combinatorial complexity, can potentially have a greater impact on policy decisions and how they affect system efficiency performance.

Finally, the utility of these concepts is demonstrated in an implementation case study. This methodology generates a prescriptive dynamical production frontier which defines the optimal production resources required to satisfy system requirements. Additionally, the dynamical production frontier allows for analysis for comparisons between options during a transient period, insight into possible unintended consequences, and the ability to forecast optimal times for introducing system or process improvements.