Appendix A

Comparing SD with Other Systems Simulation Methods in IS and Management

SD differs from other simulation methods commonly used in the IS and management field, such as agent-based modeling (ABM) (Axelrod 1997; Carley 1992; Epstein 2006; Lomi and Larsen 2001), discrete-event (DE)/process-centric modeling (Banks et al. 2005; MacDougall 1987; Zeigler et al. 2000), Monte Carlo method (Fishman 1995; Kroeses et al. 2014), and genetic algorithm (Bruderer and Singh 1996; Zott 2002). The theoretical logic of SD, ABM, and DE is explanation, while Monte Carlo and genetic algorithms focus on optimization. Herein, simulation with explanatory theoretical logic can be a powerful tool for specifying and extending existing theories. Both ABM and DE are well-known and commonly used system simulation methods for theory development in the IS and management fields; SD is distinguished from them in important ways.

The ABM method focuses on how a phenomenon emerges and evolves in an adaptive system (e.g., bilateral collaborative network) where multiple agents interact with and adapt to the actions of other agents. The typical purpose is to simulate a large number of autonomous agents that interact with each other, within a simulated environment and observe emergent patterns from their interactions. The common research question is often framed as: How does interaction among agents give rise to a phenomenon?

The DE method simulates a process system (e.g., a queuing system) consisting of a discrete sequence of events in time. Unlike the structural theory of SD, the theoretical base of DE is process theory. This simulation tool is typically used to evaluate strategies for system operations as well as to predict system performance. The research question for DE modeling commonly is: How will the system perform if the activity, event, or process changes?
Regarding system theory development in the IS field, the three simulation methods, SD, DE, and ABM differ in terms of system level, scope, time duration, change continuity, and basic mathematical model. We review and compare the three simulation methods in Table A1.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>System Dynamics</th>
<th>Agent-Based Model</th>
<th>Process-Centric (Discrete-Event, DE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System classification</td>
<td>Complex feedback system</td>
<td>Complex adaptive system</td>
<td>Process system</td>
</tr>
<tr>
<td>Theory base</td>
<td>Structural theory</td>
<td>Behavioral theory</td>
<td>Process theory</td>
</tr>
<tr>
<td>Typical purpose</td>
<td>Examine how initial conditions of a system affect the stability of the system over time</td>
<td>Test what occurs after agents interact and how a phenomenon emerges and evolves</td>
<td>Evaluate strategies for operating a system or predicting system performance</td>
</tr>
<tr>
<td>Research focus</td>
<td>Modeling a wide range of feedback effects with delayed and circular causality</td>
<td>Modeling interactions among intelligent agents</td>
<td>Modeling one or more stochastic events</td>
</tr>
<tr>
<td>System level</td>
<td>Strategic level</td>
<td>All levels</td>
<td>Operational and tactical levels</td>
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<tr>
<td>System scope</td>
<td>Aggregated individuals/homogeneous</td>
<td>Individual/heterogeneous</td>
<td>Individual/heterogeneous</td>
</tr>
<tr>
<td>System key elements</td>
<td>Stocks and flows</td>
<td>Agents, actions</td>
<td>Entities, activities, and queues</td>
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<tr>
<td>System duration</td>
<td>Long-term and mid term</td>
<td>Short-term to mid-term</td>
<td>Short-term</td>
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<td>System change</td>
<td>Continuous</td>
<td>Discrete</td>
<td>Discrete</td>
</tr>
</tbody>
</table>

Appendix B

Sensitivity Test of Model Behavior on Market Share
Appendix C


Appendix D

Model-Generated Behavior: Front-End E-Commerce Capability Accumulation Over 10 Years
Appendix E


Appendix F

Model-Generated Behavior: Revenue Over 10 Years

References

