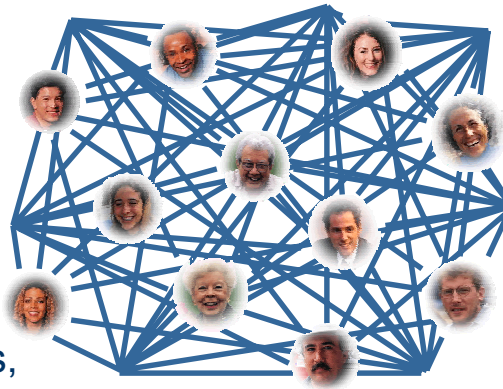


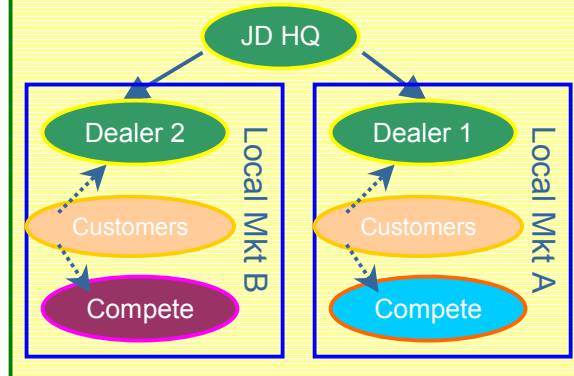
Agent-based modeling is an established tool to explore the complex dynamics that would exist in a Value Chain

- Agent-based modeling is a type of computer simulation in which many objects are represented individually as are their interactions; agents are entities in the simulation that are autonomous, and may be able to learn and adapt
- Agents may be individual people, or they may be households, companies, or governments as well
- Agents typically have individual characteristics that differentiate them from other agents – example characteristics include age, race, gender, preferences, beliefs, income, education
- Agent-based modeling is a proven successful method at PwCC, with clients in many different areas



John Deere knew they could do a better job with their dealer incentive program, and they wanted try different approaches to see how changes in the program might incentive effectiveness

PwC built an agent-based simulation in which each dealership was an agent that reacted to changes in dealer incentive programs, changes in market demand, and changes in competitive dealer practices



Agent-based modeling is an ideal tool to simulate Value Chains, as Value Chains can consist of many different entities, each with their own goals, preferences, interactions, and characteristics

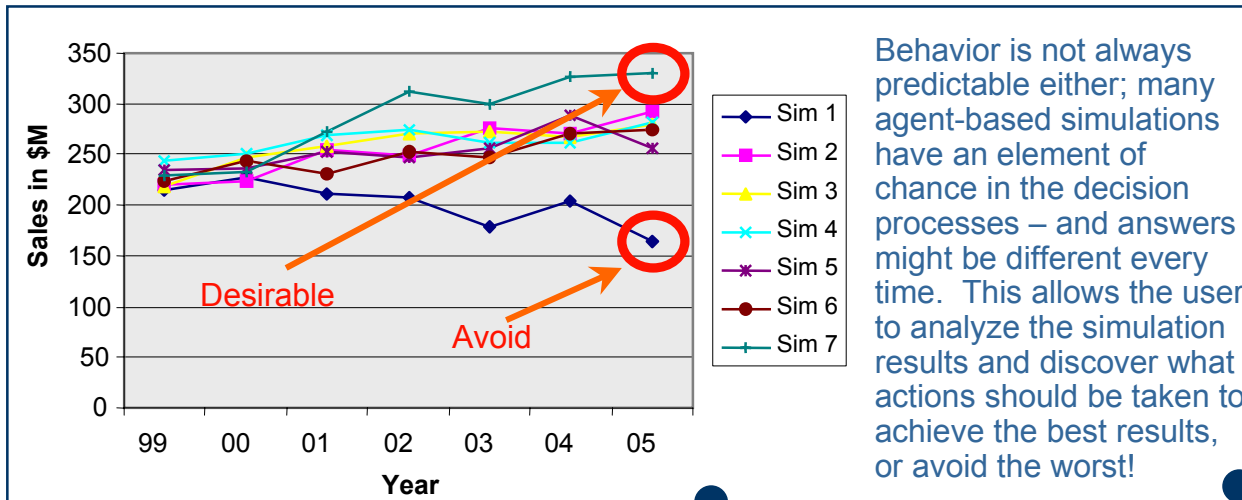
Agent-based modeling allows the ability to see what might happen in the future, gaining insight as to how to change the network relationships in order to achieve the firm's objectives

Simulations are frequently viewed as “event-driven”; for example, machine X fails every 17 hours on average, product throughput is 4500 per hour.

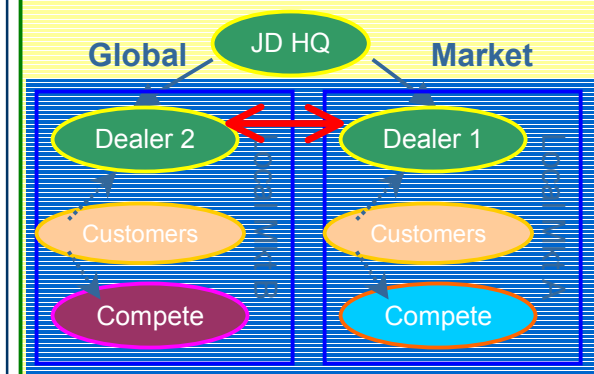
But people are not machines!
They plan, adapt, and evolve.



Using the agent-based simulation, John Deere experimented with the types of incentives that they gave to the dealers, basing on them on either local or global market share.

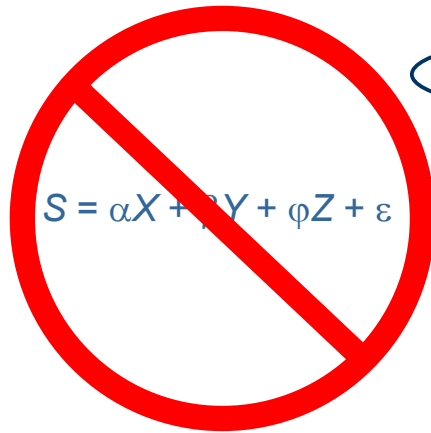


Behavior is not always predictable either; many agent-based simulations have an element of chance in the decision processes – and answers might be different every time. This allows the user to analyze the simulation results and discover what actions should be taken to achieve the best results, or avoid the worst!



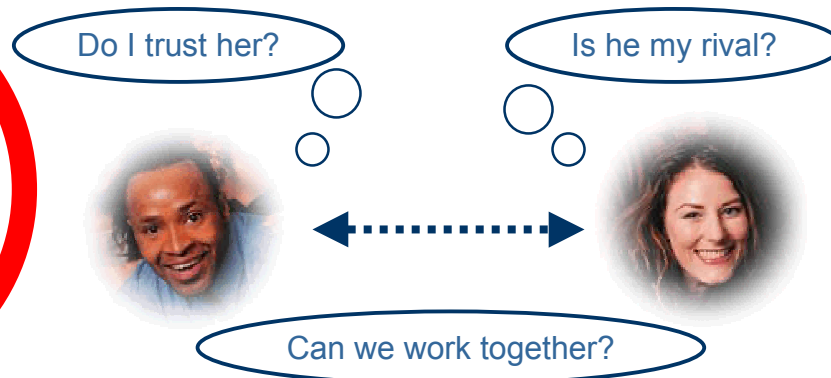
IN REALITY AND IN SIMULATIONS, TIME PASSES, NETWORKS CHANGE

Agent-based modeling and social network analysis can reveal counterintuitive insights in Value Chains that would not be revealed using conventional linear models



$$S = \alpha X + \beta Y + \phi Z + \varepsilon$$

Linear models produce results that are straight line extrapolations of the input data. They can be modified and expanded for many other types of relationships, but they do not do well when dealing with messy data such as people, thinking, and relationships

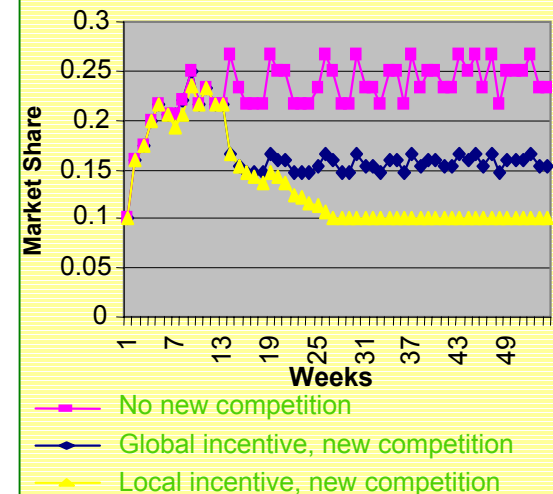


With important issues such as trust, structure, synergy and rivalries, we are exploring a fuzzier realm of thinking, acting and reacting

Such issues require representations of people and their relationships to one another, such as in agent-based modeling



By giving incentives to John Deere dealers for increasing their market share in the global market, rather than simply their local market, simulated dealers responded by increasing effort even in the face of new local competition at week 13.



We can learn from agent-based modeling by constructing the simulations, validating them, performing what-if experiments, and altering the assumptions

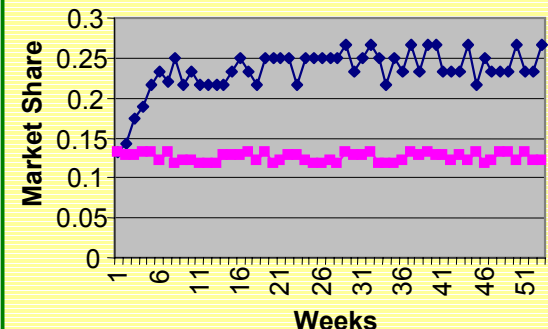
Agent based modeling requires four steps

- **Construction of the simulation**
 - Who are the stakeholders?
 - What are their relationships?
 - What kind of interactions do they have?
 - Who else might be involved?
- **Validation of the simulation**
 - Does what we have constructed seem to represent reality?
- **Performing what-if experiments**
 - Suppose that X happens, what might happen in the simulation?
 - What if we implemented policy Y?
- **Altering the assumptions**
 - Does A really trust B as much as we think?
 - Are there other behaviors that would cause that event to happen?



Executives were able to try different dealer incentive programs and see how varying them might alter their effectiveness and dealer market share. Using combinations of incentives, they were able to develop a dealer incentive program that was both economical, effective, yet still worked for nearly all their dealers.

Incentive to increase dealer effort nearly doubled local market share



PwC Consulting uses established proprietary construction tools to create realistic agent-based simulation models

The **Archimedes** simulation platform provides a system for modeling agent behavior in a framework that is easily accessible and extensible to domain experts.

The platform allows PwCC to rapidly create a Value Chain simulation after analysis and investigation of the client's existing relationships

