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# BUSINESS-TO-BUSINESS E-COMMERCE WARGAME

S y n t h e t i c

A n a l y s i s

E n v i r o n m e n t s

S i m u l a t i o n

**Alok Chaturvedi**

[alok@mgmt.purdue.edu](mailto:alok@mgmt.purdue.edu)

**Shailendra Mehta**

[mehta@mgmt.purdue.edu](mailto:mehta@mgmt.purdue.edu)

**SEAS LAB**

Krannert Graduate School of Management

Purdue University

Phone: 765 494 9048

Fax: 765 494 1526

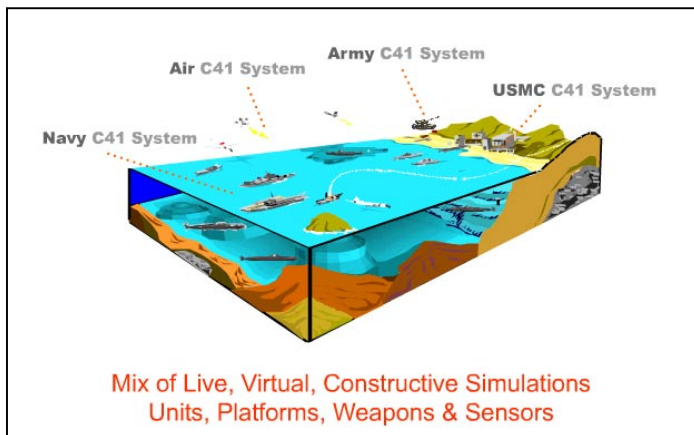
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## BUSINESS WARGAMING

Business wargaming is the management counterpart of combat simulation, where battles are fought in marketplaces rather than battlefields, and where the main players are people and programs (manufacturers, distributors, resellers, and business customers) and jobs or organizations rather than planes, tanks, and ships. Business wargaming allows experimentation of alternative management (versus battlefield) decision-making policies under pre-specified scenarios, e.g. what effects going direct have on market share, and subsequently on company's revenue and profit?

Another major difference between business wargaming and combat simulation is the technology used to build each. As opposed to the top down, discrete event approach favored by combat simulations, business wargaming uses bottom up, agent-based simulation wherein software agents programmed with rules of engagement represent individuals or organizations. In this world, human players represent organizations, and the collective behavior of the individual software agents model markets and market forces.

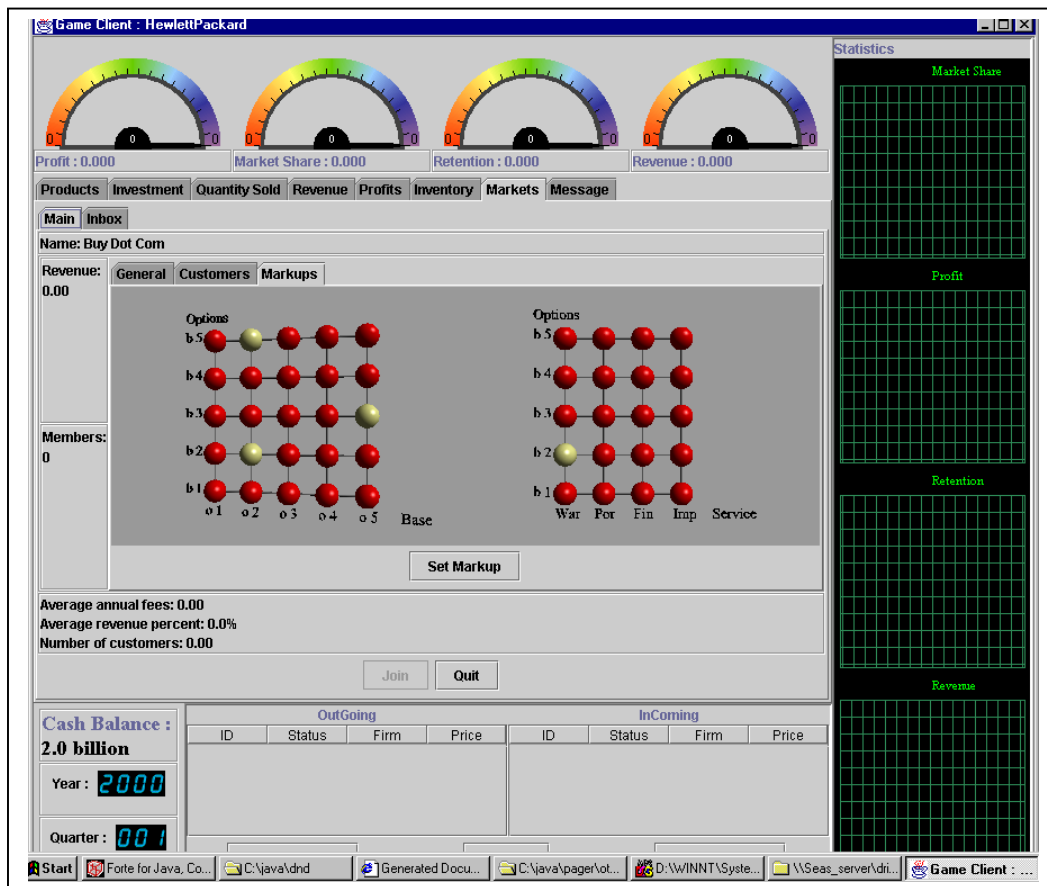
Business wargames can take the form of a standalone game such as the popular commercial product, SimCity, or of a multi-player game. PSEAS is an example of a synchronous, multi-player game, that is, all players must be on site. The environment that facilitates the simulation game is called the Synthetic Environment for Analysis and Simulation (SEAS), which has been developed over the past five years at Purdue University.



**Figure 1.** The Department of Defense wargaming environment. It consists of a synthetic terrain on which three classes of entities interact. These entities are live (e.g. a live army exercise somewhere in the Mojave Desert), Constructive (e.g. a person in a flight simulator or a tank simulator) and virtual (software agents). This environment enables DOD to simulate a theatre level of war with a small number to people.

## SYNTHETIC ENVIRONMENT FOR ANALYSIS AND SIMULATION (SEAS)

SEAS is a result of four years of research and development at Purdue University's Krannert Graduate School of Management. The United States Department of Defense and many other business and government organizations collaborated in the development of SEAS. SEAS seamlessly incorporates all aspects of managerial decision-making to provide a complete and integrated view of economies, industries, and organizations.



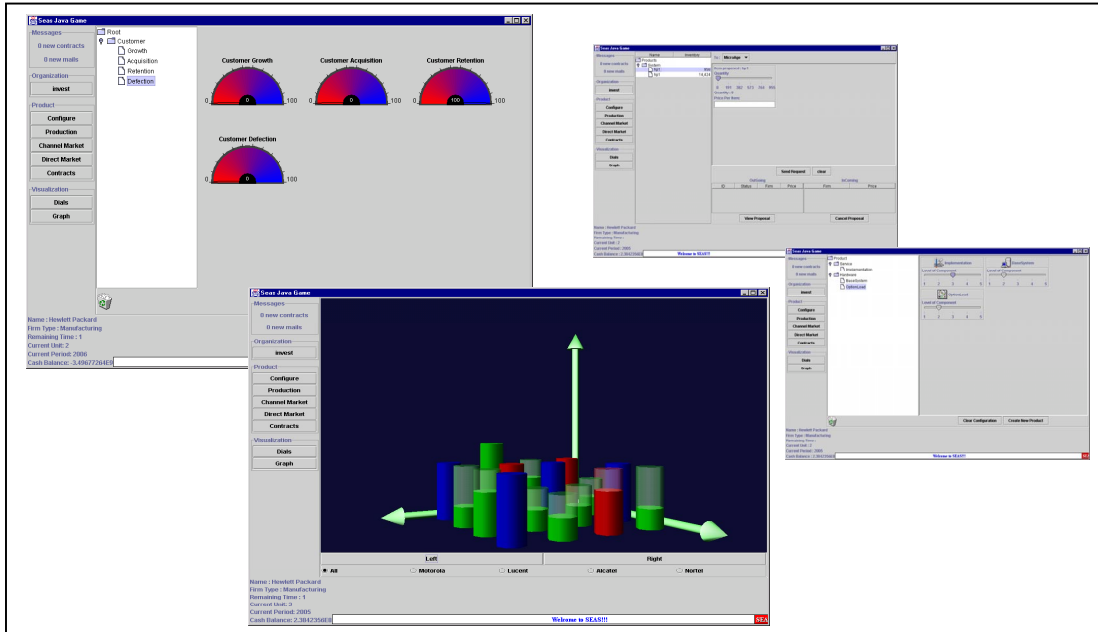
**Figure 2.** SEAS intuitive, easy to use Interface allows a player to be a full participant within minutes

The following are some of the essential features of SEAS:

### Technical features

- It is a **web-based** distributed computing environment that is robust and fault tolerant
- It employs a state-of-the-art networking, collaboration, data-warehousing and knowledge management technologies

It employs genetic algorithms that allow for re-configurable systems. One can customize its



**Figure 3.** Component based software architecture allows us to configure SEAS and its artificial economy to the exact specification of the customers' requirements

framework and the rules of engagement (such as organizational behavior rules, trading rules, regulatory constraints, and foreign policy) to the users exact needs using a high-level interface, and **dynamically alter them during a LiveCase exercise.**

### Economic features

- It can model the **global economy** as a collection of inter-linked national economies, and each national economy can be **governed independently**
- It can model an arbitrarily large number of **configurable and inter-linked** goods and services, labor, asset and foreign exchange markets
- Its production and demand processes can be **arbitrarily complex and can be plugged in seamlessly**
- It can incorporate all the essential features of the government, including the legislative, executive and judicial branches.
- It can incorporate external and environmental variables pertaining to technical change, growth or societal shifts

### Management features

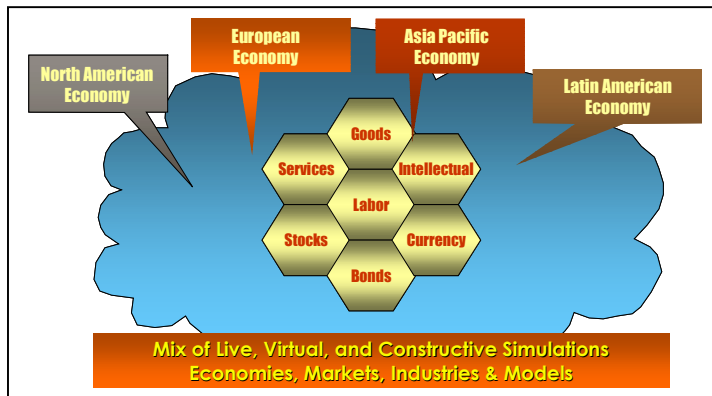
- It supports a full complement of management functionalities such as strategy, production, marketing, finance, and human resources. In addition, one **can**

**configure SEAS to model any firm, in any industry, in any economy at any level of detail**

- It can incorporate quantitative relationships as well as qualitative relationships which are calibrated using actual data and can be updated in real time as new data emerges either in the real world or in the simulation

#### **Organizational features**

- **It records participants' every action and communication**
- It can accommodate **arbitrarily large numbers of human and artificial agents** playing in the same setting.
- It provides high level decision making and analytical tools to every participant
- It allows teams to collaborate internally by sharing the various decision making functions across several different entities
- It has a highly evolved **visualization and decision support system** that allows the human players to rapidly assimilate and use the large quantity of real time information generated during the LiveCase.



**Figure 4.** SEAS' synthetic economy. It is a collection of interlinked goods, services, stock, bond, labor, currency, and intellectual property markets. Economies too can be interlinked to form a global economy. Three classes of agents interact in this economy. They are live (real people), virtual (software agents) and constructive (people with the help of a decision support system).

**PSEAS SETTING:  
B2B E-COMMERCE IN  
THE PC INDUSTRY**

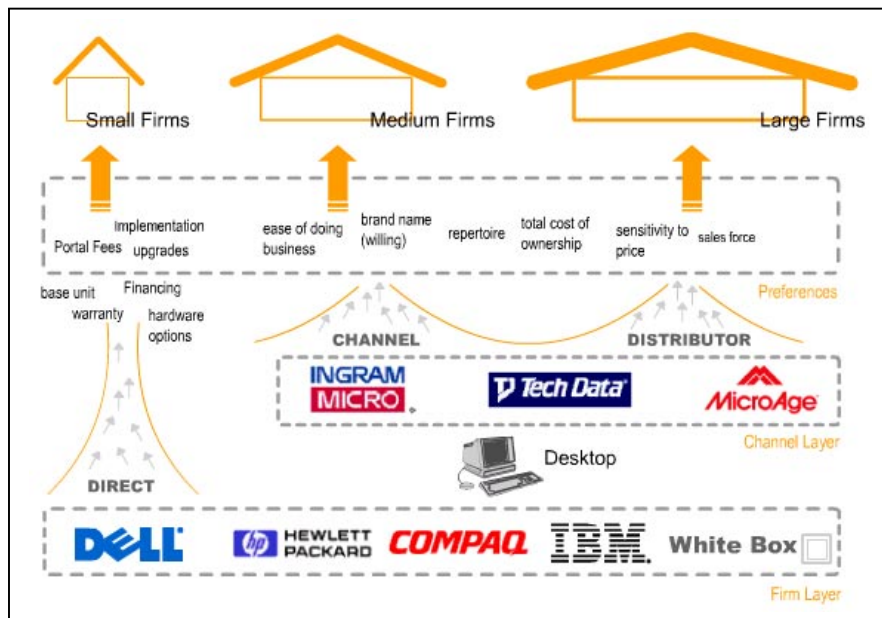
Business-to-business e-commerce is the new battleground for firms in the PC industry. Dell Computers pioneered the direct-sales business model that every other PC maker is trying to emulate, but with limited success. In this disintermediated model, an OEM abandons distributors, wholesalers, and retailers and sells directly to the end customer. There are several advantages of this model. First, by building computers to order, the company economizes inventory and prevents the depreciation due to technological obsolescence. Second, it allows the OEM to be paid before it builds computers and pays its suppliers. Third, it allows the OEM to capture the lucrative add-on services such as warranties, financing, upgrades, and portal services.

So, what prevents the other PC makers from adopting the direct model? With the traditional business model, OEMs developed a web of relationships with the channel firms, who do the assembly and supply to the final customers. The problem is that the latter "own" the customers, and provide the profitable parts of the computer value chain - the add-ons. By going direct, a traditional computer company runs the risk of alienating the channel. If that happens, the intermediary can set up competing operations by teaming up with generic PC makers.

The design of the Synthetic Economy was as follows:

1. In the SEAS environment, we created a synthetic economy representing the PC industry and populated it with four classes of agents – computer makers, channels and service providers, and business customers.
2. IBM, Dell, Compaq, Hewlett Packard, Whitebox Maker, and NoName Computer Maker represented the computer makers.
3. Ingram Micro, Tech Data, Inacom, and MicroAge represented the channel firms
4. PCEx, a fictitious company represent a neutral B2B exchange
5. We divided the business customers into three segments – small, medium, and large. Each of these segments has two sub-segments -- the “self-integrator” segment and “need help” segment. We calibrated the behavior of the artificial agents to closely resemble that of the segment they represent in the “real economy.”

6. We allowed human agents to play the roles of computer makers and channels while thousands of artificial agents performed the roles of business customers.
7. There were two classes of products sold in the economy – goods and services. The goods sold in the market are the base units and option loads. Each of these goods had five levels representing five different qualities. There were four classes of services – warranty, implementation, financing, and portal.
8. Firms could make several different types of investments to improve their performance -- such as ease of doing business, e-branding, sales force, information portal, facilitation, transactions, and integration.



**Figure 5. Virtual Game Board.** PC Industries partial value-chain. We use publicly available data to calibrate the synthetic economy. Customers may also inject their private data. **Special procedures are in place to protect customers' proprietary data.**

## PSEAS™ FEATURES

### Selling and Buying Options for Players

Customers are not played by participants but are integrated as virtual agents into the model. Virtual agents are artificially intelligent software agents that reproduce the behavior of the consumers. In fact, when the model is run, it is as if all the customers were deciding to buy their supplies for the whole period. Depending on the offer from manufacturers and dealerships (this decision is made by the teams) and on their personal preferences, customers, or virtual agents, choose the best offer they find. This is why different categories of customers, each with different buying behaviors, are introduced in the model.

One of the most important decisions that participants have to make in the *Game* is which market they are going to choose to sell their products in. They have to decide if they take the risk to antagonize the channels, if they segregate products by channels, how to markup products according to channels, etc. PSEAS distribution alternatives are presented in Figure 6.

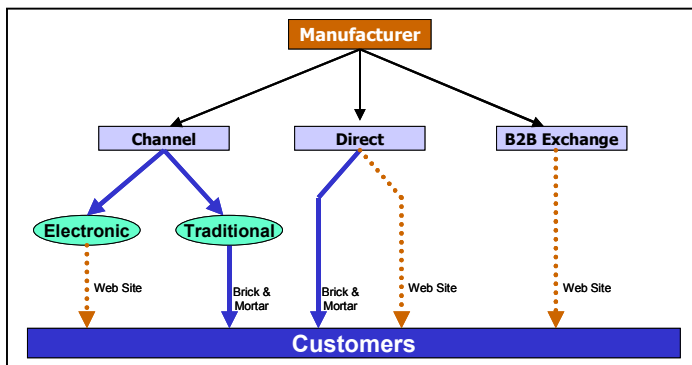


Figure 6. B2B e-business Models

Manufacturers have the following choices:

*Manufacturers have the following choices:*

1. Sell to the channels, whether they are traditional distributors (T.D.) or e-distributors (E.D.). One

manufacturer make an offer to one distributor directly by sending him a message with the product type, quantity and price specifications of the product he wants to sell. The distributor accepts or refuses the offer.

2. Sell direct to customers.
3. Sell through B2B exchange web sites to channels or to customers. Manufacturers can create their own platform joined by customers and suppliers (suppliers of manufacturers are not included in the model) or they can join the platform of their customers.
4. Sell through the neutral “shopping mall” B2B neutral marketplace.

*Traditional distributors have the following choices:*

1. Sell direct to customers, whether it is through their web site or their stores,
2. Create a B2B exchange web site and have their suppliers, the manufacturers, join them to facilitate transaction (but do not authorize competition to join),

## OPERATING DECISIONS

Join or create a neutral B2B exchange marketplace (with competition).

### *E-distributors can:*

1. Create a B2B exchange web site and have their suppliers join it to facilitate transaction (but do not authorize competition to join)
2. Join a neutral B2B exchange marketplace,
3. Create a neutral B2B exchange marketplace and play the role of the neutral agent.

Another way to look at the different distribution alternatives is looking at the different way of doing business. There are four ways:

1. **Channel:** manufacturers sell to channels (T.D. or E.D.)
2. **Direct:** manufacturers and channels sell directly to customers through the traditional way (M., T.D.) or via their web site (M.<sub>ws</sub> T.<sub>ws</sub>, E.D.)
3. **B2B exchange:** manufacturers or distributors open their own platform joined by their suppliers and customers or join a supplier/customer platform.
4. **B2B E-Hub (neutral exchange):** several competitors of the industry at different levels (manufacturers, distributors and customers) join a neutral platform.

### *Pricing Decisions*

Price is defined by product and product category, as a markup over cost. This allows participants who do not know the products well, and who would consequently not know if a price for a given product is high or low, to make accurate decisions. They will have a sense of what the market is willing to accept. For manufacturers, the markup can be changed while negotiating with distributors. However, the last markup chosen before the market closes will decide of the pricing strategy for selling direct for the whole period.

### *Production Decisions*

Production is defined by Product. The forecasting of how much to produce of each product not knowing what the market will be is an important decision component.

### *Distribution*

Distribution is also defined by Product. The four choices that manufacturers have are:

## OPERATING INVESTMENTS

they can sell through channels (T.D. or E.D.), B2B exchange, B2B neutral exchange marketplace or direct. If products are not sold through channels or B2B exchange, the rest of the production is by default sold direct through the manufacturer's web site or through traditional channel and to customers.

### ***Channel support – marketing <push> strategy***

An investment is allocated to each channel. Within each channel, the investment is allocated by products only (not by Products). Customers are characterized by their product production rather than by the type of products they buy. If they produce corn, they will be sensitive to any news about corn, whether it is about Products or pesticides. A single investment number (U.S.\$) is determined for each channel and then allocated across products.

For traditional distributors, the investment covers advertising expenditure (specialized magazines and local newspapers), promotion expenditure (promotion, incentives, free trials, test plots) and sales force support.

For e-distributors, the investment covers advertising expenditures (specialized magazines, local newspapers and specialized web sites), promotion expenditure (promotion, incentives, free trials, test plots) and level of technical information available on the web site.

The investment for direct sales covers advertising expenditure (specialized magazines and local newspapers), promotion expenditure (promotion, incentives, free trials, test plots) and sales force support. The impact of the marketing-push strategy investment is to increase sales and reduce cash.

### ***Marketing <pull> strategy***

The marketing-pull strategy expense is defined by product only (as a total investment and then an allocation of the total across products). This investment covers the general support across channels to build the image of the company: television ads, radio, trade shows, field days, direct mail, everything not channel related that builds the image of the manufacturer. The impact of investing in this area is an increase in sales but this investment may have less of an impact than the channel support. It also reduces cash.

### ***Logistic Support***

A single investment (U.S.\$) is determined per manufacturer and applies across all products and product Categories. Logistics support includes warehousing, transportation manage

ment, taking orders, anything that enhances logistics activities. The impact is an increase in sales because of the improvement in service and a reduction in costs because of a better efficiency. It also reduces cash.

#### ***Customer Support***

The first customer service provided is from manufacturer to the customer. The investment is defined by product only (as a total investment and then an allocation of the total across products). It includes technical support (1800 number), special services, programs with partners (universities, etc.), web support staff, etc. This represents added value services provided by manufacturers.

The second customer service provided is from manufacturer to distributors. A single investment (U.S.\$) is determined per manufacturer and applies across all products and Categories. It includes technical Support (1-800 number), special services, and programs with partners (universities, etc.). The investment impacts all product inputs sold through distributors.

## **STRATEGIC INVESTMENTS**

#### ***Research and Development***

R&D investment is made by Product. A time lag is defined, based on the market acceptance and the quality of the product. R&D is one of the major strategic elements of the industry, as it leads to the development of new products and new varieties that are of fundamental importance in this market.

Participants will also be able to invest in new product lines. This investment will consider the lag between the first investment, the time the product will be launched and the dollar amount necessary every year during this period of time to build the new product line.

#### ***Investment in e-commerce***

Manufacturers have the option to build and improve their web site with a single investment across all products and product Categories. The impact is an improvement on the ease of doing business and consequently an increase in sales and a reduction of cash.

For each investment, there is an obsolescence variable introduced, i.e. if the firm does not invest enough in comparison with other firms, sales will be impacted.

## OBJECTIVES

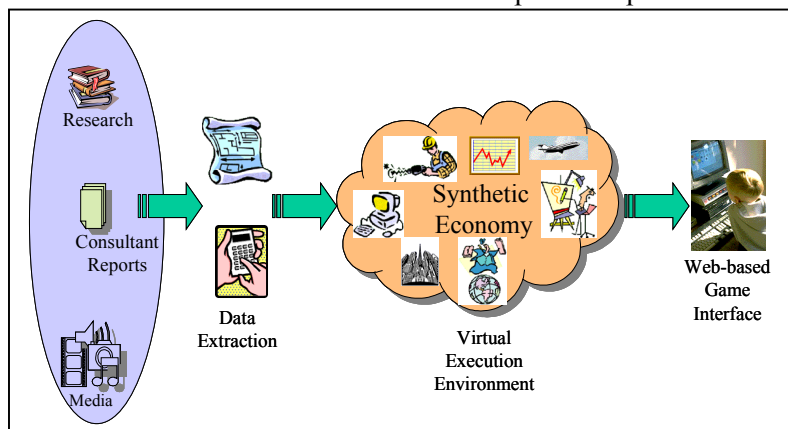
**PSEAS** focuses on how various entities in the value-chain function and interoperate under differing external circumstances. The “Aha!” experiences we expected from playing the game are increased participants' insight and awareness into the following issues:

- Adoption of different e-biz models by the players in response to the changes in environment.
- Interaction among the various entities in the value chain (e.g., manufacturers, traditional channels, e-channels);
- Implications of a manufacturer going "direct" on its channel partners;
- Nature of channel conflicts and their implications;
- Effect of B2B exchanges on manufacturers' and channels' margins, market shares, and profitability.
- How sustainable are these business models?

As such, the focus is on the *process* than *outcome*. Thus, the outcome of any particular engagement which may arise in the simulation was of less concern than the tradeoffs and decisions which the various players made in the process of responding to competitors and partners moves, and the effects those tradeoffs and decisions had upon the other players in the game.

## DATA SOURCES & VERIFICATION

Data from several sources were used to populate and configure the PSEAS synthetic economy for LiveCase. Data used to calibrate the behavior of artificial agents came from analysts' reports, published articles, and consultants' reports. Company and product specific data came from Annual Reports, SEC filings,



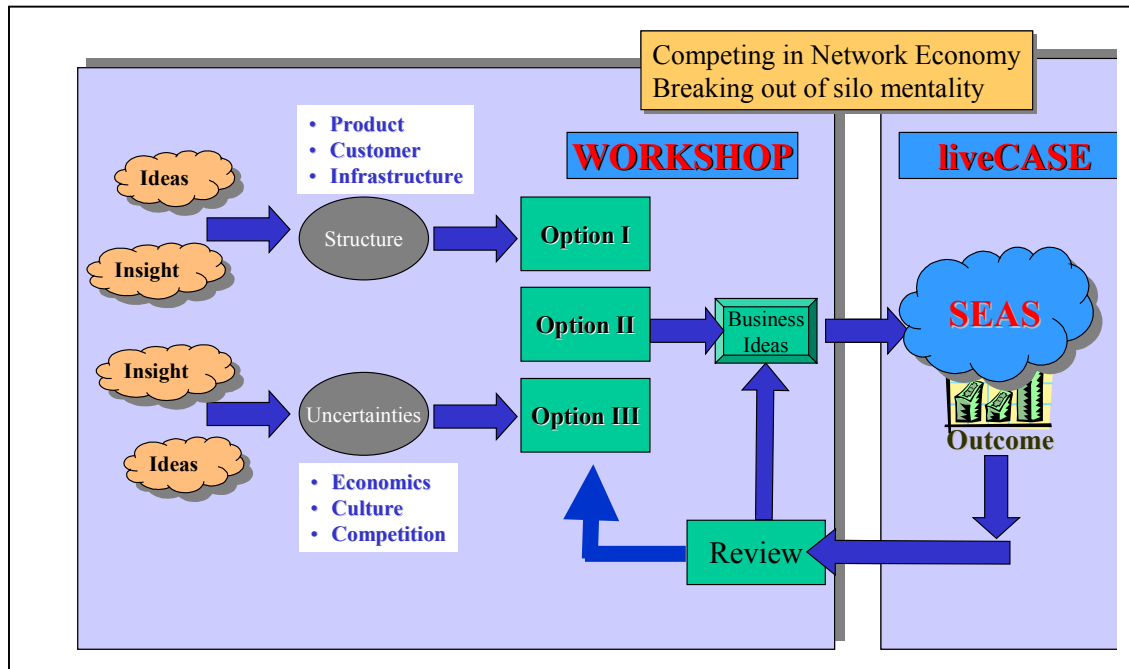
Company Websites, and published materials. Critical customer behavior data were verified from different sources. Missing data was obtained by interviewing industry experts.

Once the economy was populated, agents' behaviors were calibrated and verified against a few known scenarios to create the SEAS virtual execution environment.

**Figure 7. SEAS Virtual Execution Environment.**  
Data from several sources are used to populate and calibrate SEAS virtual Execution Environment.

**LIVECASE  
METHODOLOGY**

Figure 8 describes the methodology adopted for the exercise. The exercise comprises of several steps; some involved a facilitator and the others used computer-based simulation. The first step involved ideas and insights generation. In this step, participants brought forth their own ideas, insights and understanding of the issues facing the companies they represent and the industry as a whole. The second step involved testing these ideas and insights against the industry



**Figure 8: PSEAS liveCASE methodology** uses a combination of workshop and computer-based simulation for maximum impact.

structure pertaining to relative positions of firms on product mix, customer perception, and infrastructure sophistication. In addition to the structure, the ideas and insights were also tested for robustness against economic, cultural, and competitive uncertainties. The fourth step involved the development of different options and business ideas. The fifth step involved testing the business ideas in SEAS' synthetic economy. The sixth and final step involved after action review, in which participants discussed their moves, counter-moves, and outcomes.

<ul style="list-style-type: none"> <li>• Workshop <ul style="list-style-type: none"> <li>– Identify competitive advantage</li> <li>– Address devil’s advocate questions</li> <li>– Identify the distinctive competencies</li> <li>– Develop business prototype idea</li> <li>– Vulnerability analysis, testing, and reworking of the business idea</li> <li>– Identify strategic implications</li> <li>– Develop implementation plan</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Live Case <ul style="list-style-type: none"> <li>– Identify the customers you are competing for</li> <li>– Test your business definitions</li> <li>– Identify the key competitors and their competencies</li> <li>– Competing business model analysis</li> <li>– Competitor response profiles</li> <li>– Identify your IT investment profiles</li> <li>– Analyze the risks and rewards of the different business models and investments</li> </ul> </li> </ul>
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**Table 1.** Objectives of the Workshop Live Case

**THE QUESTION**

The participants addressed the following question in the liveCase exercise:

*How can manufacturers strike the appropriate balance between direct online sales, traditional distribution, and selling through Business-to-Business Exchanges?*

*How would the role of channel firms evolve?*

*Is B2B exchange a viable solution?*

*How many exchanges are too many?*

## LESSONS LEARNED

During the workshop and discussions, the manufacturing firms developed five options to explore:

1. Stay a pure manufacturer
2. Develop a symbiotic relationship with the channel
3. Go direct aggressively with bundled services
4. Subscribe to an existing B2B Exchange
5. Collaborate with other manufacturers and channel firm to create a new B2B exchange

The channel firms, likewise, identified five options to explore:

1. Just add value through service
2. Develop a symbiotic relationship with the manufacturer
3. Compete aggressively with the name brand firms through whiteboxes.
4. Subscribe to an existing B2B Exchange
5. Collaborate with manufacturers and other channel firms to create a new B2B exchange

## ROUND I

When PC manufacturers first considered venturing into "going direct," they did so with much trepidation. They did not want to roil the retailers on which they so intimately depend. The retailers, carefully watching the rise in the number of manufacturers going direct, kept the pressure on manufacturers to restrict their efforts to bypass their traditional sales channels.

### TRADITIONAL PLAY

1. The boxmakers quickly discovered one of the fundamental sources of channel conflict – that they wanted to send fully loaded boxes while the channel wanted “stripped down” versions of boxes. The channels were quite successful in playing off one manufacturer against the other.
2. As a result the boxmakers quickly discovered that the only way to move fully loaded boxes was to go direct. (See next section).
3. This preference for going direct was reinforced by the finding that the channels were increasingly turning to the generics to supply them with low end machines.

### GOING DIRECT

1. Manufacturers found going direct challenging, as they feared channel firms could fight back by concentrating on white boxes. However, indecision proved to be even worse. Gradually many came to the realization that there was no alternative. (As mentioned in the previous section.)
2. Regardless of the difficulty of selling direct, manufacturers still found ways to sell direct to customers without offending the distribution channel, e.g.,
  - a. Some manufactures negotiated with their channel partners to sell only certain configurations direct and the rest through them. Thus, the channel partners did not find them in direct competition.
  - b. Successful manufacturers in the war game sold low base systems with low option load through the traditional channel and high-end systems direct.
  - c. Manufacturers who offered a wide range of products through the channel and made no investment in direct sales facility, very quickly lost their bargaining power. Without appropriate infrastructure to sell

*Openness and partnership were very important when dealing with the channel.*

*Even if the manufacturer decided to cooperate with the channel, it was essential that they acquired some capacity to sell direct. It kept the channel honest.*

*If a manufacturer was planning to go direct, making investments in service was of utmost importance. Going direct "naked" was the worst of both worlds.*

## WHITE BOX PLAY

*Having an option to go direct can be more powerful than going direct.*

direct, and without a channel firm to sell their products, these manufacturers ended up losing substantial market share, and lost their leverage with the channel. When they finally did decide to go direct, it was too little too late. Their customers had left them and very few returned.

- d. Going direct with just hardware proved difficult. These firms did not gain enough new customers to justify their move and lost the trust of the channel to boot. Manufacturers bundling service ended up with higher profit margins and market share.
1. White box play was the ace up the sleeve of the channel firms. As more manufacturers resorted to direct selling, the channel firms came back aggressively with white boxes and bundled them with service.
2. Power play for margins was quite evident in the exercise. Some manufacturing firms used "reward power" to entice channels to cooperate. In this power play, the manufacturing firm allowed the channel to take margins on low-end base systems while they went direct with the high-end configurations. This approach seemed to work in the short run and the channels' bargaining power gradually eroded. Two channel firms ended up being rather insignificant pure value-added resellers.
3. However, when the channel firm was aggressive with the right mix of white boxes and branded products, it wielded significant market power. In certain cases, it was even able to exert "coercive power" on the manufacturer, especially with those brands that found going a bit tough. These manufacturers had to agree to bigger share of the profit on options in order to sell their systems.
4. In situations where there was intense competition between channel and the manufacturer, Dell's position strengthened further. However, when there was a trustful and cooperative relationship between the manufacturers and the channel, Dell's ending position was a significantly weaker.

## ROUND II

In round II of the war game a neutral B2B exchange was introduced. In a B2B exchange multiple buyers and sellers come together to trade. **PCex** was set up as a vendor neutral exchange. In other words, it had no interest in success or failure of the participating members. Every OEM and channel firm had the choice to subscribe to this exchange. The key strategic issues the players had to consider were:

1. Status quo
2. Sell all direct
3. Sell high valued products direct
4. Sell commodity and surplus products through the exchange.
5. Sell direct to Value-added Resellers
6. Go all out through B2B exchange.

## NEUTRAL EXCHANGE

B2B exchanges allowed a complex set of strategic alternatives to OEMs. The choices were between three different business models -- traditional, direct, and through the exchange.

1. The evolutions of firms adopting different business models were quite interesting. For example, one OEM team successfully segmented the market. They sold commodity PCs through the exchange, used the direct model to serve the high value accounts with high end systems, and used value-added resellers to sell to small and mid-sized customers who had higher needs for service.
2. Dell's direct model was under great pressure once the B2B exchange acquired a critical mass. However, it continued to do well until a second exchange came on line.
1. PCEX that started as an exchange for surplus and commodity product became a full service vertical market. This resulted in channel companies becoming pure service providers.

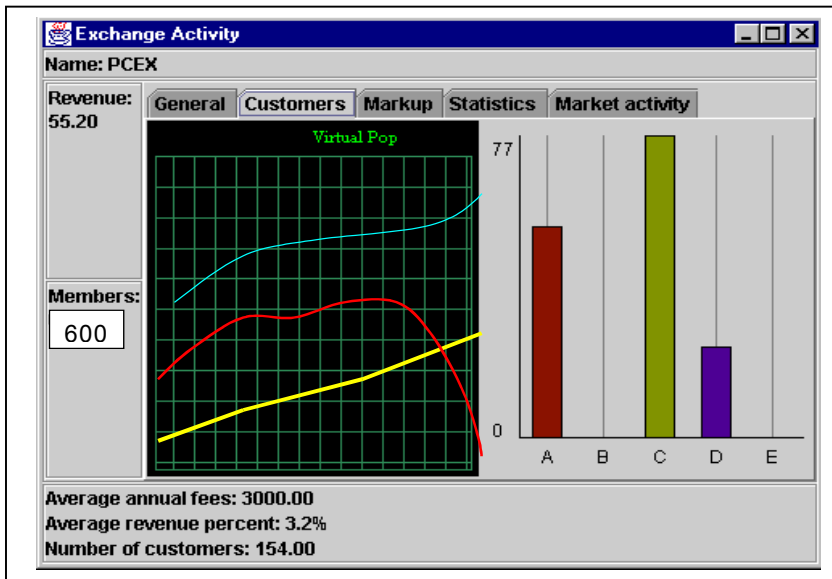
Prices were lower, the margins were higher with the exchanges as the transaction and search costs for the customers came down. An interesting hybrid business model that worked was to sign up customer on the exchange and then service them direct.

2. Multi-vendor bundling of hardware and service, but administered by one party was also quite popular with the customers. Dell became even stronger when it created its own exchange. It eventually sold everything through the exchange. (Private Exchange)

## B2B EXCHANGE BECOMES A FULL SERVICE VERTICAL MARKET

*There are several B2B e-commerce models. No single model is going to give a company a sustained competitive advantage. Innovative hybrid business models will provide the highest growth opportunity.*

3. As long as PCEX was the only game in town, they wielded considerable market power resulting in substantial increase in customer value surplus while the profits for the members (sellers) also remained high.
4. When Dell introduced its own private exchange inviting service providers to join them, its performance was even stronger. It eventually sold everything through the exchange.
5. To counter Dell, teams playing IBM, HP, and Compaq along with Tech Data and Ingram Micro created their own "seller biased" exchange. At this point competition among exchanges became very intense. Having no real support from the vendors, PCEX's losses began to mount.



6. Feeling left out of the action, MicroAge created its own exchange (MA.com). However, the volume sold here was miniscule, and PCEX and MA.Com merged.

7. Customers were well off with one neutral exchange. Now with three exchanges, customers were confused and switched rapidly between exchanges and between firms. As a result, their surplus was much lower and brand loyalty was greatly diminished.

**Figure 9. B2B Exchange.** The B2B interface describes the number of members currently subscribed to the exchange, the average annual fees, revenues etc. A participant playing the role of an exchange can develop and test the impact of different pricing and community building strategies.

8. Failing to sustain its business model, MA.Com (intermediary oriented exchange) reduced investment in its exchange and chose to become a niche player supporting "branded" surplus and whiteboxes.
9. Markets became very stable with two prominent exchanges. Dell continued to have high profits and volumes with its own exchange but the growth in its market share slowed down considerably because customers seeking best price migrated to the sellers' exchange to lower their search costs.
10. Profit margins for IBM, Compaq, and HP were quite high. Each of these firms was able to maintain its positions quite well and was able to segment its markets quite effectively.
11. Two dominant and stable exchanges and an efficient niche player (2 + 1 model) seemed to be the optimal solution. In this case, the customer surplus was quite high, the switching was low, and the search and transaction costs were quite low.

12. The "community" effect was the strongest in the (2 + 1) model where customers were comfortable in their respective camps. Churning here was almost negligible.
13. This equilibrium was attainable because of Dell's dominant market position (gorilla status). No other firm was able to sustain a private exchange for long. However, the persistent theme in very exercise was that the market eventually evolved into (2+1) model.

## SUMMARY

SEAS LiveCases allow researchers and experimenters to understand emergent complexity of the relationships emanating from the implementation of different business models, customers and competitors responses to the moves by:

- creating a synthetic environment resembling the real world in all its crucial dimensions such as competitors, products, customers, and consumers
- simulating the strategic interactions between the firm and its environment