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The DS-9 transparency dynamics: To be or not to be… transparent?

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Abstract—Changing the transparency of principals, agents or technologies affects power relations with the users of transparency. Drawing on Plato's allegory on the relation between *true being* and the *illusions of the sense world*, this essay explores the complexity of such changes in three stages. *First*, nine Deming Scholars (DS-9) use systems archetypes to interpret some of the G7/G8 summit clarion calls for greater transparency in political and military spheres. *Second*, the essay presents a framework for shifting managerial attention from single- and double- to multi-loop learning, a potentially significant requirement for combating greed and fee-driven deals when they come into play. *Third*, using a generic system dynamics simulation model, a hypothetical pro forma example from office real estate development, investment and finance shows how the manipulation of project assumptions (whether attributable to *irrational exuberance*, faulty data or poor forecasts) can significantly affect real estate investment decisions and cause office space oversupply.

Keywords: investment decisions, office space, real estate, simulation modeling, system dynamics

Plato's allegory speaks of people living in such a condition that they become the dwellers of a shadow world. They are chained and perceive but the shadows of themselves and all real objects projected on towards where their faces are turned (Fig. 1). All movements to them are but movements on the surface, all shapes but the shapes of outlines with no substantiality.

Figure 1 Plato's allegory

Plato's allegory shows the relation between true being and the illusions of the sense world. People liberated from their chains could learn and discover that the world is solid and real. Then they could go back and tell bound companions of this greater higher reality. Thinkers who have been liberated have gone into the thought of the ideal world, into the world of ideas greater and more real than the things of sense. They can come and tell their fellows of that which is truer than the visible sun—more noble than Athens, the most transparently visible state.

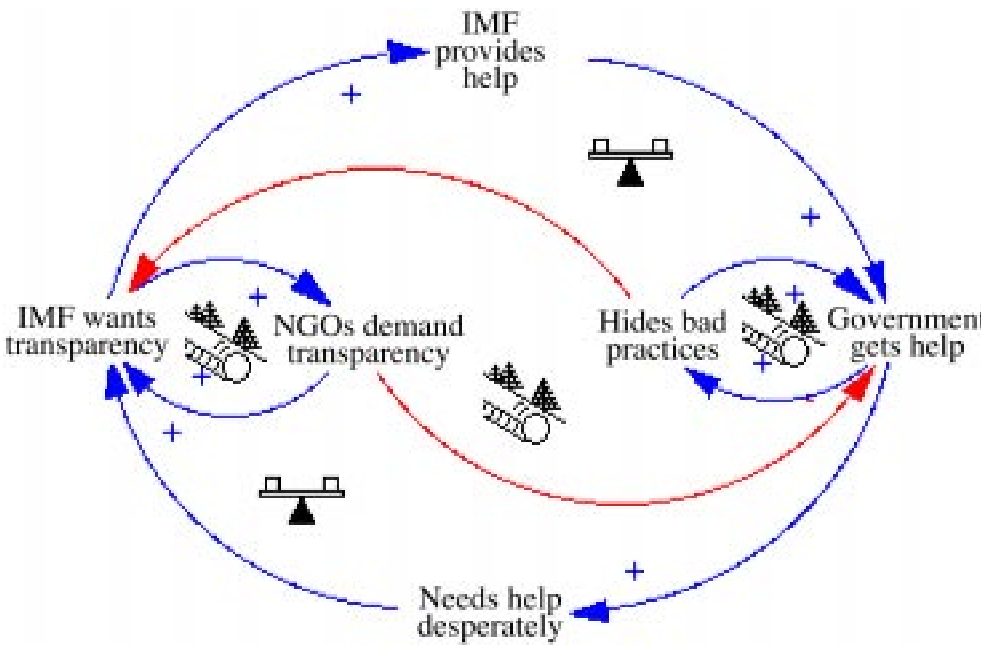
About 2,500 years later, transparency is on the rise, touted as the solution to such disparate problems as financial volatility and risk, environmental degradation, money laundering and corruption (von Furstenberg 2001). But transparency (or the lack thereof) faces extreme opposition, particularly from those actors under scrutiny. Such actors often have selfish motives and very strong incentives to be less forthcoming with information, especially information that might reveal questionable business policies and practices. To explain the growing demand for transparency and to assess its prospects for success requires attention to matters of politics, i.e. power. Power can induce disclosures or restructure incentives. And the information thus revealed can shift power from former secret holders to the newly informed.

In response to the clarion calls for greater transparency in political and military spheres, nine Deming Scholars (DS-9) have used systems archetypes to interpret some of the underlying G7/G8 summit concerns. The DS-9 group argues that since so many see transparency as a solution, in *systemese*, transparency must be embedded in balancing structures, and as such, subject to systems archetypes that contain predominantly balancing loops. A small sample of the archetypes the DS-9 group applied to transparency include: accidental adversaries, fixes that fail, shifting the burden, drifting goals, success to the successful, and tragedy of the commons.

The DS-9 transparency archetypes

Figure 2 depicts a needy government with bad practices asking for help from the international monetary fund (IMF). In order to help, IMF requires that governments be completely transparent in their polices and practices. If there are bad practices, such as corruption, there will be no help. Therefore, the needy government hides its bad practices in order to get help.

Figure 2 Accidental adversaries transparency archetype



In response (Fig. 2), the IMF and other non-government organizations (NGOs) demand more transparency in order to provide help to a needy government. If a needy government is less transparent, the IMF provides less help. However, less help by IMF might turn a needy situation to desperate situation. So, the IMF eventually provides some help in order to forestall a desperate situation. As a result, the needy government ultimately gets IMF help and continues to hide its bad practices in order to get more help. And the IMF continues to ask for more transparency in order to give more help.

Figure 3 shows how the lack of infrastructure and basic necessities that plague poor countries is both a cause and a consequence of poverty (the symptom). Generally, the IMF or other NGOs believe that one of the fixes that may result in a better economy for such a country is greater transparency for its government. This fix is intended to bring to light various forms of corruption such as kickbacks, which work against the creation of a better infrastructure that would in turn lead to a better economy and poverty alleviation. The unintended consequence of such a fix is that those in power bury the information sought even deeper and thereby less transparency of the relevant information is the result. This keeps the status quo of a poor infrastructure or, worse yet, adds to further deterioration of the existing services.

Figure 3 Fixes that fail transparency archetype

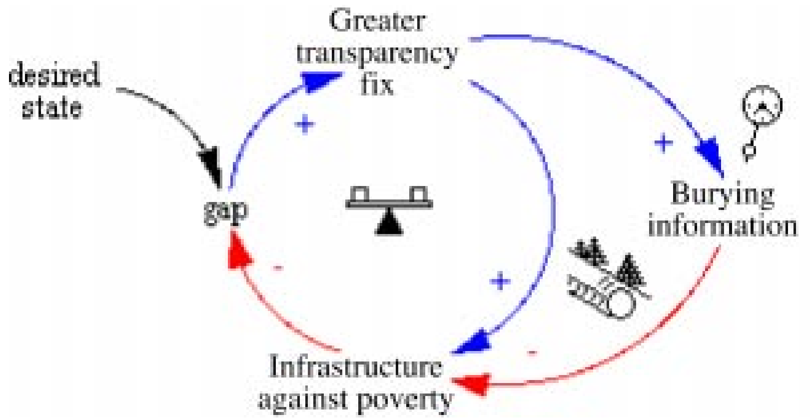
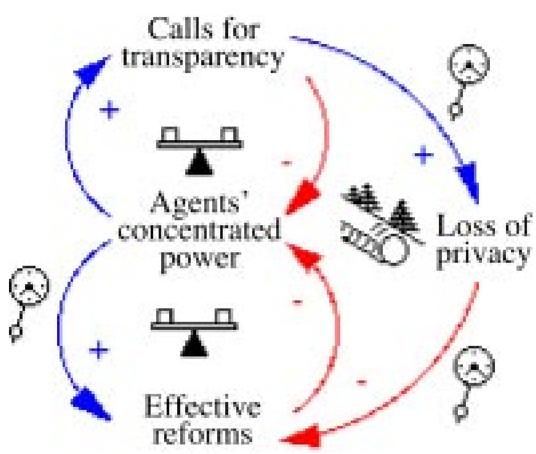


Figure 4 shows that agents (i.e. government workers, politicians, judges, etc.) have concentrated power. And principals (i.e. voters, citizens, residents, etc.) want to diffuse the wrongful exercise of such power. A possible solution to address agent/principal relationship is to have greater transparency by and for all parties involved. A side effect of such transparency is that there is a loss of privacy for the principals. This loss comes about since the agents' workings and information will necessarily include information about the principals themselves. The fundamental solution in this case may be to bring about effective reforms, such that there is not a concentration of power in the hands of a few.

Figure 4 Shifting the burden transparency archetype

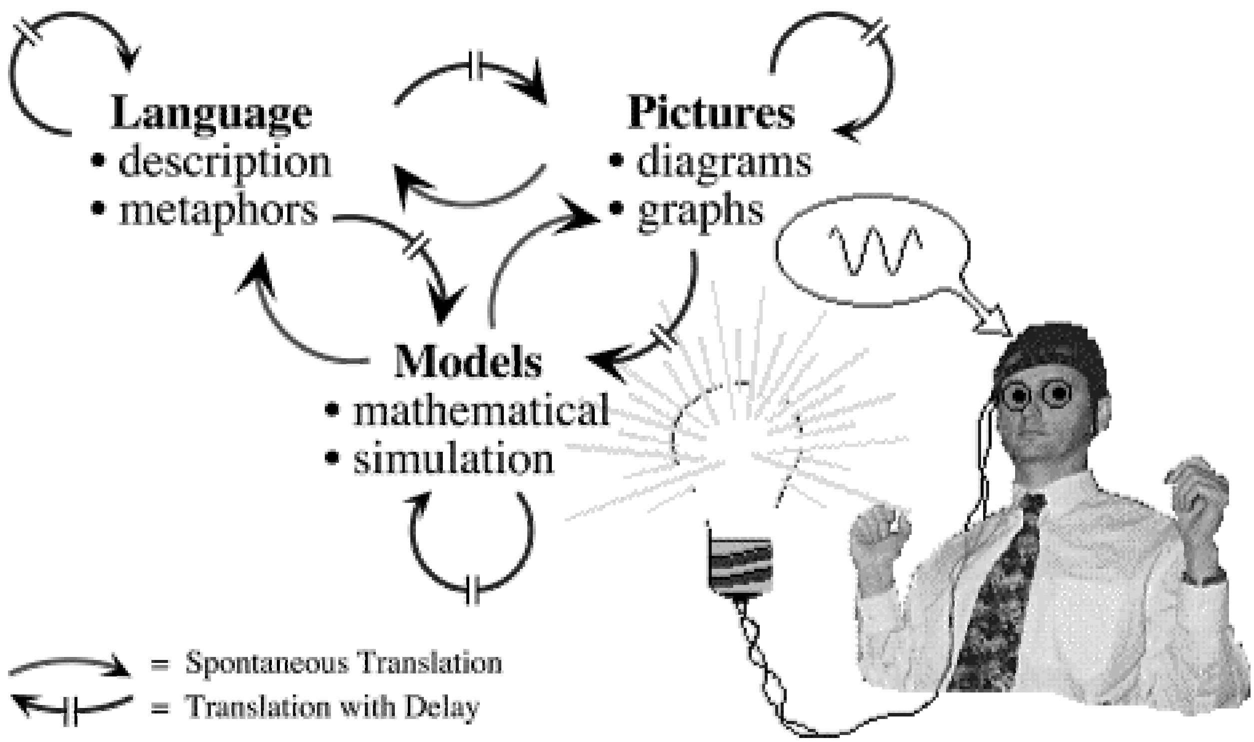


Now, having sampled the work of the DS-9 group, you might feel ready to take Plato's suggestion; but literally, not metaphorically. System archetypes might live chained, in a world that is lower than the world of learning, in world that shadow figures and shadow motions are its constituents; and to it one can contrast the real world of learning. As the real world is to the shadow world, so is the higher world of system dynamics modeling for learning to the system archetype world. Can you accept this analogy, will you?

High-level learning and system dynamics

Effective decision making and learning in a world of growing dynamic complexity requires managers, agents and principals to become true system thinkers. To synchronize their mental models with today's business and political realities, they must use high-level learning (Fig. 5). Clarion calls for transparency notwithstanding, today's system thinkers must preserve rigor and help discern contemporary business phenomena, such as the emerging self-organizing business networks within autopoietic industry value chains.

Figure 5 Framework for shifting from single- and double- to multi-loop learning



High-level learning requires multi-loop translations among language, pictures and models. The metaphorical application of systems archetypes, which link business to science, nature and society, do cover the translations in and between language and pictures (top of Fig. 5). Undoubtedly, these capture the imagination of business managers and scholars. Benefiting from systems thinking, however, requires preserving its rigor with simulation modeling—the same tool used for the advancement of modern science itself (Turner 1997).

Explicit mathematical or simulation models are selective representations of managers' daily contact with the business reality. The relevance of modeling for learning by today's business manager, scholar and student has much to do with our struggle of defining, refining and reperceiving our daily contact with reality (Georgantzas & Acar 1995). The modeling process provides a different way of seeing managerial problems, a different mindset for thinking about business situations and for learning from their experiential ramifications. The process entails using *all* translation feedback loops of Fig. 5.

An example from real estate development, investment and finance

Looking for transparency in the field of office space real estate development, investment and finance might be potentially significant when greed and fee-driven deals come into play. A hypothetical, static office space (OS) real estate pro forma model (Table 1) shows how the manipulation of project assumptions (whether attributable to *irrational exuberance*, faulty data or poor forecasts) can significantly affect real estate investment decisions and office space supply.

Table 1 Hypothetical, static office space (OS) real estate pro forma

	Conservative		Optimistic		Aggressive	
	Low	High	Low	High	Low	High
Gross Buildable Area (GBA)	150,000	150,000	150,000	150,000	150,000	150,000
Loss Factor Deduct	20%	20%	20%	20%	20%	20%
Usable Sq.Ft. (USF)	120,000	120,000	120,000	120,000	120,000	120,000
Loss Factor Add-back	5%	5%	10%	10%	15%	15%
Rentable Sq.Ft. (RSF)	126,316	126,316	133,333	133,333	141,176	141,176
nnn (triple-net) Rent (RSF)	$13	$15	$16	$18	$19	$21
Acquisition Price (GBA)	$65	$70	$60	$65	$55	$60
Hard Costs (GBA)	$40	$45	$35	$40	$30	$35
Soft Costs (GBA)	$25	$30	$20	$25	$15	$20
Total Project Cost (GBA)	$130	$145	$115	$130	$100	$115
Capitalization Rate	9%	9%	9%	9%	9%	9%
Discount Rate	10%	10%	10%	10%	10%	10%
Income Growth Rate	3%	3%	3%	3%	3%	3%
Holding Period (in years)	10	10	10	10	10	10
Cash Flow (cf)						
cf year 0 (equity)	(19,500,000)	(21,750,000)	(17,250,000)	(19,500,000)	(15,000,000)	(17,250,000)
cf year 1	1,642,105	1,894,737	2,133,333	2,400,000	2,682,353	2,964,706
⋮			⋮			
Capitalized Value (Yr. 11)	24,520,580	28,292,976	31,855,796	35,837,770	40,053,978	44,270,187
cf year 10	2,142,575	2,472,202	2,783,516	3,131,456	3,499,862	3,868,269
cf year 11	2,206,852	2,546,368	2,867,022	3,225,399	3,604,858	3,984,317
Unleveraged DCF Measures						
Return on Equity (ROE)	8.42%	8.71%	12.37%	12.31%	17.88%	17.19%
IRR	10.96%	11.49%	17.37%	17.28%	24.61%	23.77%

The finance literature refers to 'asymmetric information' or 'principal/agent conflict' (Cole & Eisenbeis 1996). Graaskamp (1988) remarked that every expense item on a project budget is a profit center for somebody. Land assembly profits, construction profits, lending institution staff bonuses, consulting fees, project management fees and securitization fees reward decision makers, even where projects eventually fail. As one agent put it, "A lot of people don’t get paid unless a deal happens." More deals mean, however, that it is less likely that all projects can perform as projected (Kummerow 1999).

The client, as an agent of another in the process of buying, selling, leasing or managing office space property rights, presented Table 1 to the modeling team as hypothetical and not representative of any particular investment project. Table 1 depicts how sensitive discounted cash flow (DCF) measures are to changes in the low-to-high ranges moving from conservative to optimistic to aggressive project assumptions.

The conservative model is considered the baseline analysis of comparison, i.e. a project with relatively low investment risk due to less speculative assumptions. On the other hand, the optimistic and aggressive models employ more speculative assumptions, implying greater investment risk. Here are some basic definitions of the Table 1 terms:

Acquisition price: the price of existing real property improved and/or unimproved necessary as well as administrative expenses incidental to site acquisition and/or redevelopment.

Capitalization rate: the rate that is used to discount future cash flows to determine value. The capitalization rate reflects both the lenders' and the investors' expectations of inflation, risk, and so on.

Capitalization: the process of estimating value by discounting stabilized net income by an appropriate rate.

Capitalized value: the capitalized value is derived from dividing Year 11 cash flow by the capitalization rate.

Discount rate: the required rate of return (or interest rate) used to discount future cash flows to determine present value. It reflects both the lenders' and/or the investors' expectation of inflation, opportunity cost, risk and so on.

Discounted cash flow (DCF): the process of discounting future value into present value, which is the opposite of compounding.

Equity: also known as venture capital because it involves greater risk. It represents an interest in real property after all claims and liens have been satisfied.

Gross buildable area (GBA): the amount of square footage that reflects the actual lot area or the footprint approved for development.

Growth rate: the rate at which annual cash flow is increased.

Hard costs: also referred to as direct costs, these are expenditures for the labor and materials necessary to construct improvements to real property.

Holding period: the duration of time for which an investment is held.

Internal rate of return (IRR): the rate of return (or discount rate) at which the net present value (NPV) of expected future cash flows to the initial capital investment is equal to zero.

Loss factor add-back: a method that converts USF to RSF.

Loss factor deduct: a method that converts GBA to USF.

Net present value (NPV): the net present value of an investment is the sum of the total present values of the annual cash flows plus the present value-estimated proceeds from the sale less the amount of equity investment (or project cost). If the difference is greater than zero, a net gain will be realized from the investment.

NNN (triple-net) Rent: base rent payable by a tenant to a landlord pursuant to terms and conditions stipulated by a lease, which is net of operating and electric expenses as well as real estate taxes.

Present value: the current value of an income-producing asset that is estimated by discounting all expected future cash flows over the holding period.

Project costs: also referred to as development costs, these cover all expenditures (including hard and soft costs) to create a property and bring it to an efficient operating state. Project costs include the profit to the developer or entrepreneur who brings the project into being.

Rentable square feet (RSF): the amount of square footage upon which a tenant will pay rent.

Return on equity (ROE): sometimes also referred to as the equity dividend rate, the return-on-cost (ROC) or the cash-on-cash (COC) return. This is the ratio of before-tax cash flow to investor's equity invested in the project.

Soft costs: also referred to as indirect costs, these are expenditures for items other than labor and materials—such as administrative costs, lease-up costs, and other professional fees.

Usable square feet (USF): the amount of square footage that reflects the actual area of a floor or a building suite that is suitable for occupancy.

Office space real estate system dynamics model description

A simple system dynamics model (Fig. 6 & 7) used some of the above definitions to highlight the structure underlying basic interactions within the office space real estate value chain. The model incorporates a rudimentary formulation, a generic value-chain management (VCM) structure, that allows modeling customer-supplier value chains in business as well as in physical, biological and other systems. Although the VCM model structure is for the most part generic, its situation specific parameters faithfully reproduce the dynamic behavior patterns seen in cyclical office space oversupply (Kummerow 1999, Shilton 1988).

Adapted from Hines, Eberlein, Richardson et al. (2000), the VCM segment of the simulation model (Fig. 6) helps explain the sources of oscillation, amplification and phase lag generally seen in customer-supplier value chains; phenomena which executives at 3M, Bristol-Myers Squibb, Hewlett-Packard and P&G collectively call the *bullwhip effect* (Hau, Padmanabhan & Whang 1997). Locally rational policies that create smooth and stable adjustment of individual business units can, through their interaction with other functions and firms, cause oscillation and instability, i.e. bullwhip-like dynamics. The model incorporates policy parameters pertinent to decision making office real estate development, investment and finance. The results reveal policies that office space developers and their suppliers can use to improve performance.

Following the description of the system dynamics model below is the interpretation of its dynamics. It is perhaps its capacity to reintegrate the content and process perspectives of strategy that has turn system dynamics into a new paradigm for competitive advantage (Istvan 1992), and simulation modeling (Georgantzas 2001b) in general into a critical fifth tool in addition to the four tools used in science: observation, logical/mathematical analysis, hypothesis testing and experiment (Turner 1997).

But system dynamics models also allow computing scenarios to assess the possible implications of strategic situations. These are not merely hypothesized plausible futures, but computed by simulating changes in strategy and the business environment (Georgantzas & Acar 1995). Following the description of model structure, a set of computed scenarios assess what might happen to office space real estate as project parameters change transparently from conservative to optimistic to aggressive project assumptions.

Office space real estate sector

A major bullwhip-effect component, oscillation requires *both* that time delays exist in the negative feedback loops controlling a system and that VCM fails to account for them. Managers often ignore the supply chain of corrective actions initiated but which have not yet had their effect. Although foolish to ignore time delays, case studies in real estate and shipping as well as experimental data show that people often do exactly that (Sterman, 2000).

Like all firms, office space real estate projects are sets of processes. Their order fulfillment, service delivery, advertising, hiring and firing, and pricing are all processes. Each requires inputs acquired from suppliers. A customer-supplier value chain is the structure that acquires the inputs, transforms them into outputs and delivers them to customers. Customers can be external (e.g. tenants/landlords) or internal (e.g. landlords/tenants) and the inputs and outputs can be tangible (e.g. an office building and its parts and raw material) or intangible (e.g. a concert performance where the output is a soul-inspired, spiritually rejuvenated audience).

Figure 6 shows the stock and flow diagram of an office space real estate generic value-chain management (VCM) structure. In system dynamics models, rectangles represent stocks, i.e. state variables that accumulate through time, such as the Office Space (OS) and OS Supply Chain of Fig. 6. The double-line, pipe-and-valve-like icons that fill and drain the stocks, often emanating from cloud-like *sources* and ebbing into cloud-like *sinks*, represent material flows that cause the stocks to change. The construction rate, for example, shows the flow from OS Supply Chain to Office Space. Single-line arrows show information flows, while circular icons depict auxiliary constants, behavioral relationships or decision points that convert information into decisions. Changes in the construction rate, for example, depend on the OS Supply Chain delivery adjusted by a construction lag time. The diagram of Fig. 6 is reproduced from the actual simulation model built using *iThink® Analyst* 6 (Richmond et al. 2000).

Figure 6 Office space real estate sector (adapted from Hines et al. 2000)

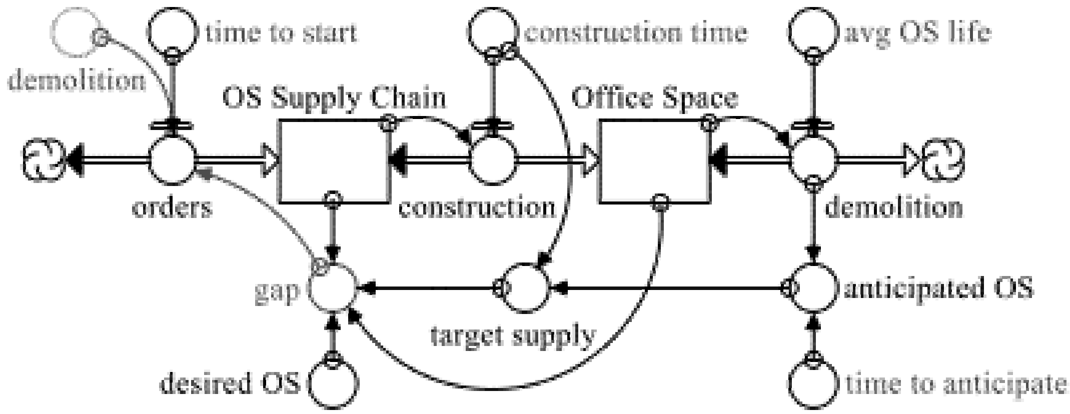


Table 2 Office space real estate sector equations

Stock or Level Variables	Eq. #
Office Space(t) = Office Space(t - dt) + (construction - demolition) * dt	(1)
INIT Office Space = desired OS {Units = sf (square feet)}	(1.1)
OS Supply Chain(t) = OS Supply Chain(t - dt) + (orders - construction) * dt	(2)
INIT OS Supply Chain = target supply {Units = sf}	(2.1)
Flow or Rate Variables	
construction = max(0, OS Supply Chain / construction time) {Units = sf/year}	(3)
demolition = max(0, Office Space/avg OS life) {Units = sf/year}	(4)
orders = max(0, (demolition + gap) / time to start) {Units = sf/year}	(5)
Auxiliary Variables & Constant Parameters	
anticipated OS = SMTHN(demolition, time to anticipate, 1) {Units = sf/year}	(6)
avg OS life = 1{Average bed life; units = years}	(7)
construction time = 1 {Units = years}	(8)
desired OS = 20000000 + step(4000000, 1) {Units = sf}	(9)
gap = max(0, desired OS - Office Space) + max(0, target supply - OS Supply Chain) {Units = sf}	(10)
target supply = anticipated OS * construction time {Units = sf}	(11)
time to anticipate = 1 {Units = years}	(12)
time to start = 1 {Units = years}	(13)

Value chains entail a stock and flow structure (top of Fig. 6) for the acquisition, storage and conversion of inputs into outputs, and decision rules (bottom of Fig. 6) governing the flows. The jet ski value chain, for example, includes the stock and flow networks of material such as hulls and bows pulled out of jet ski molds. The hulls and bows travel down monorail assembly paths prior to their shipment to dealers. At each stage in the process, there is a stock of parts buffering production activities (e.g. an inventory of fiberglass laminate between hull and bow acquisition and usage, an inventory of hulls and bows for the lower and upper structure of the jet ski, and an inventory of jet skis between dealer acquisition and sales). The decision rules governing the flows entail policies for ordering fiberglass laminate from suppliers, scheduling the spraying of preformed molds with three to five layers of fiberglass laminate before assembly, shipping new jet skis to dealers and customer demand, i.e. desired OS (bottom of Fig. 6).

The office space real estate value chain consists of cascades of supply chains, which often extend beyond even an integrated firm's boundaries. Effective VCM models must incorporate different agents and firms, including suppliers, buildings, distribution channels and customers (e.g. tenants/landlords). System dynamics is well suited for the office space real estate VCM modeling and policy design because real estate development, investment and finance entail multiple chains of stocks and flows, with time lags and delays, and because the decision rules governing the flows create feedback loops among value-chain participants or value- and supply-chain partners.

There is a one-to-one correspondence between the diagram of Fig. 6 and the model equations (Table 2). Like the diagram of Fig. 6, the equations are also the actual output from *iThink® Analyst* 6. The model was built by first diagramming its structure on the glass of a computer screen and then specifying simple algebraic equations and parameter values. The software enforces consistency between the diagram and the equations, while its built-in functions help quantify policy parameters and variables pertinent to office space real estate VCM.

The stock and flow structure of Fig. 6 shows OS Supply Chain as unfilled orders for new Office Space, i.e. orders that have been placed but not yet received. The OS Supply Chain stock (Eq. 2, Table 1) is the accumulation of orders (Eq. 5) less construction (Eq. 3).

The *max* function of Eqs 3 through 5 (Table 2) ensures that construction, demolition and orders do not become negative. Orders cannot be negative in most situations. Once fiberglass laminate is delivered, for example, and sprayed on preformed jet ski molds, it cannot be returned. In cases where excess units can be returned, different cost and criteria usually govern the returns process, so it must be modeled separately, not as a negative orders rate.

The stock to be controlled, Office Space (Eq. 1, Table 2), is the accumulation of the construction rate (Eq. 3) less the demolition rate (Eq. 4). The demolition rate that drains Office Space arises from economic and/or functional obsolescence. The demolition rate depends on Office Space (Eq. 2), but can also depend on other endogenous or exogenous variables and parameters, such as the average OS life (Eq. 7).

Generally, Office Space managers cannot simply add new square footage as they wish. Acquiring new Office Space involves time lags and delays, and requires resources. New construction, for example, requires labor and equipment, and hiring new employees requires recruiting effort. Resources can themselves be dynamic and impose capacity constraints. Assuming ample process capacity, and that the only delay in acquiring new office real estate entails a construction time lag (Eq. 8), the construction rate (Eq. 3) depends on the OS Supply Chain of officially approved square footage under construction that has been ordered but not yet received and the construction time lag.

In the decision rules structure (bottom of Fig. 6), office space real estate managers order to replace Office Space and to replace any discrepancy between the desired OS (Eq. 9) and actual OS stock. The construction time lag forces managers to maintain an adequate supply of unfilled orders, so that construction is close to their target supply (Eq. 11).

Georgantzas (2001a, 2001c) and Sterman (2000, Ch. 17) give enough in-depth coverage of fundamental and widely used VCM structures in different contexts to model the management of any quantity in a value chain. However, the focus here is to shows how the manipulation of office space real estate certain VCM parameters (whether attributable to *irrational exuberance*, faulty data or poor forecasts) can significantly affect real estate investment decisions as well as office space supply.

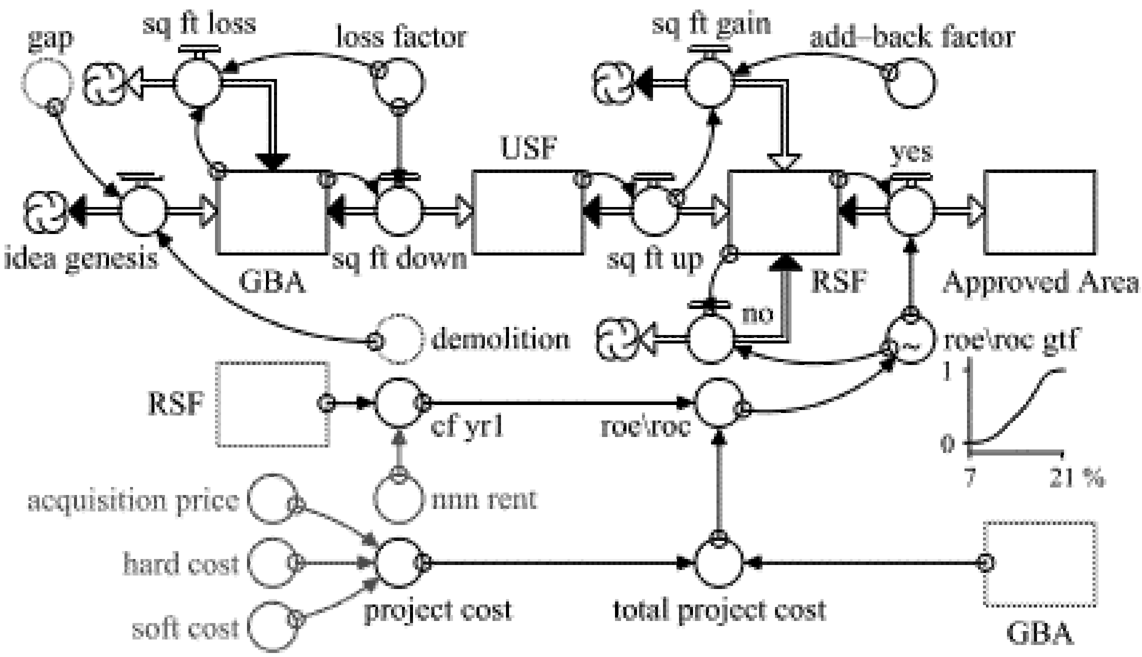
Office space real estate pro forma sector

The office space real estate pro forma sector (Fig. 7 and Table 3) shows the three square-footage stocks of gross buildable area (GBA, Eq. 15), usable square feet (USF, Eq. 17) and rentable square feet (RSF, Eq. 16) as explained by Table 1 definitions. The office real estate idea genesis rate (Eq. 18), which feeds GBA, depends on the gap (Eq. 10, Table 2) and demolition rate (Eq. 4).

Table 3 excludes their equations, however, because on Fig. 7 each of these two variables is a *ghost* (i.e. an alias image) of the variable from which it was ghosted. In system dynamics models, gray-line ghosted images keep diagrams tidy when single-line connectors might otherwise run all over, leading to *spaghetti* diagrams. Similarly, the GBA and RSF stocks were also ghosted on the lower part of Fig. 7 for the same aesthetic reasons.

The methodology (i.e. formuli) underlying Table 1 is as follows: the loss factor (Eq. 29, Table 3) converts GBA to USF, while the add-back factor (Eq. 25) in turn converts USF to RSF. Last but not least among the stocks of Fig. 7, the Approved Area (Eq. 14) accumulates the square footage approved for development.

Figure 7 Office space real estate pro forma sector



The approval of a proposed office space real estate project depends on the project's return on equity or return on cost (roe\roc, Eq. 32, Table 3). The roe\roc graphical table function (gtf) determines the probability of proposed RSF being designated either 'yes' (Eq. 24) or 'no' (Eq. 19) office space to receive project financing. According to the roe\roc gtf (lower right of Fig. 7 and Eq. 33, Table 3), all proposed square footage with a projected roe\roc of 7 percent or less are rejected (receiving 'no' project financing), while all proposals with a projected roe\roc of 21 percent or more are approved (receiving a 'yes' for project financing).

Each proposed development project's projected roe\roc (Eq. 32) depends on the ratio of the discounted year-one cash flow (cf yr1, Eq. 27) divided by the total project cost (Eq. 35). The discounted cf yr1 is a function of the nnn (triple-net) rent (Eq. 30) multiplied by the proposed rentable square footage (RSF), while the projected total project cost is a function of the projected per square foot project cost (Eq. 31) multiplied by the gross buildable area (GBA).

Those seeking capital to finance office space development projects can affect roe\roc projections by manipulating the four red parameters on the lower left of Fig. 7. Naturally, there are many more parameters, political conditions and discounted cash flow (DCF) measures one can manipulate in order to make proposed real estate development projects look 'good'. In this illustrative model, however, the client deemed the real estate acquisition price (Eq. 26), hard cost (Eq. 28), nnn rent (Eq. 30) and soft cost (Eq. 34) sufficient for testing the office space VCM sensitivity to parameter manipulation, whether attributable to irrational exuberance, faulty data or poor forecasts.

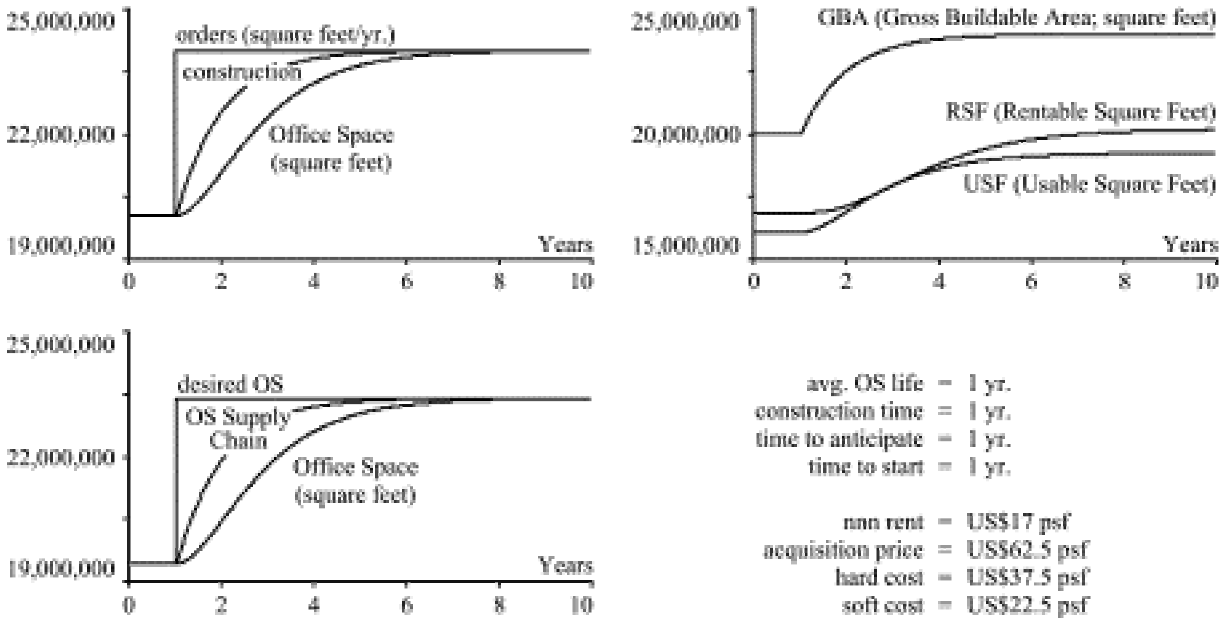
Table 3 Office space real estate pro forma sector equations

Stock or Level Variables	Eq. #
Approved Area(t) = Approved Area(t - dt) + (yes) * dt	(14)
INIT Approved Area = 0 {Cumulative square footage approved for development; units = sf (square feet)}	(14.1)
GBA(t) = GBA(t - dt) + (idea genesis - sq ft down - sq ft loss) * dt	(15)
INIT GBA = idea genesis {Gross buildable area is the amount of square footage that reflects the actual lot area or the footprint approved for development; units = sf}	(15.1)
RSF(t) = RSF(t - dt) + (sq ft up + sq ft gain - yes - no) * dt	(16)
INIT RSF = USF * add–back factor + USF {Rentable square footage is what a tenant will pay for. It is derived by adjusting usable square footage (USF) by an add–back factor; units = sf}	(16.1)
USF(t) = USF(t - dt) + (sq ft down - sq ft up) * dt	(17)
INIT USF = (GBA - sq ft loss) {Usable square footage reflects the actual area suitable for occupancy; units = sf}	(17.1)
Flow or Rate Variables {Units = sf (square feet) / year}	
idea genesis = max(0, gap + demolition)	(18)
no = max(0, (1 - roe\roc gtf) * RSF)	(19)
sq ft down = max (0, (1 - loss factor) * GBA)	(20)
sq ft gain = add–back factor * sq ft up	(21)
sq ft loss = max (0, loss factor * GBA)	(22)
sq ft up = max (0, USF)	(23)
yes = max(0, roe\roc gtf * RSF)	(24)
Auxiliary Variables & Constant Parameters	
add–back factor = .05 {Converts USF to RSF; units = dimensionless}	(25)
acquisition price = 62.5 {The price of existing real property improved and/or unimproved necessary as well as administrative expenses incidental to site acquisition and/or redevelopment; units = US$/sf}	(26)
cf yr1 = nnn rent * RSF {units = US$}	(27)
hard cost = 37.5 {Also referred to as direct cost, it covers expenditures for labor and materials necessary to construct improvements to real property; units = US$/sf}	(28)
loss factor = 0.20 {Converts GBA to USF; units = dimensionless}	(29)
nnn rent = 17 {Units = US$/sf}	(30)
project cost = acquisition price + hard cost + soft cost {Also referred to as development cost PGFASB, it includes expenditures, such as hard and soft cost, required to create a property and bring it to an efficient operating state. Project costs include the profit to the developer or entrepreneur who brings the project into being; units = US$/sf}	(31)
roe\roc = cf yr1 / total project cost {Units = dimensionless}	(32)
roe\roc gtf = GRAPH(roe\roc) {Units = dimensionless} (0.07, 0.00), (0.084, 0.01), (0.098, 0.053), (0.112, 0.128), (0.126, 0.248), (0.14, 0.374), (0.154, 0.5), (0.168, 0.7), (0.182, 0.9), (0.196, 0.99), (0.21, 1.00)	(33)
soft cost = 22.5 {Also referred to as indirect cost, if covers expenditures for items other than labor and material, such as administrative cost, lease-up cost and other professional fees; units = US$/sf}	(34)
total project cost = project cost * GBA {Units = US$}	(35)

Simulation results

Although generic, the VCM segment of the simulation model (Fig. 6) can help explain the sources of oscillation, amplification and phase lag generally seen in customer-supplier value chains. To illustrate the behavior of the VCM structure in a perfect world with minimal (i.e. one-year) time lags and delays, Fig. 8 shows the system's response to a 20 percent (4,000,000 sq. ft) increase in the desired OS (office space). Initially, the Office Space stock and the construction and orders rates are all equal at 20 million sq. ft from t = 0 years to t = 1 year. Then, at time t = 1 year, the built-in *step* function of *iThink® Analyst* 6 allows simulating a 20 percent (4,000,000 sq. ft) increase in the desired OS (top left panel of Fig. 8).

Figure 8 Response to a 20 percent (4,000,000 sq. ft) increase in the desired OS



Both the Office Space stock and the construction rate smoothly approach the new goal of 24 million sq. ft in response to the step increase in orders (top left panel of Fig. 8) caused by the corresponding step increase in desired OS. The step increase in desired OS immediately opens up a gap between desired and actual Office Space. In order to adjust, orders jump, increasing the gap of Fig. 7. Since there is no capacity constraint on construction, both the construction rate and the Office Space stock begin to rise. As they do, the office space shortfall diminishes, reducing the Office Space increase through time. As Office Space rises, however, so does demolition too. After three adjustment times (i.e. 3 years) Office Space has adjusted to about 95 percent of its ascent to its new equilibrium of 24 million sq. ft.

The consequences for the office space real estate value chain are profound. *First*, the Office Space adjustment process creates significant amplification. Note how much faster and higher the orders and construction rates must rise than the Office Space stock in order for the latter to reach its new equilibrium.

Second, amplification is temporary. In the long run, a one-percent increase in desired OS leads to a one-percent increase in construction. After two-adjustment times (i.e. 2 years) OS Supply Chain gradually falls back to match construction (lower left of Fig. 8). During the disequilibrium adjustment, however, the OS Supply Chain overshoots Office Space, an inevitable consequence of the stock and flow structure of customer-supplier VCM. The only way the Supply Chain can increase is for its orders inflow to exceed its construction outflow. Within the office space real estate value chain, the OS Supply Chain faces relatively larger changes in demand than Office Space and the surge in demand is temporary.

Third, although all variables temporarily increase, the construction's and orders' amplification remains constant. As desired OS steps up, manifested in the desired OS step, so do both rates' new equilibrium points, but in direct proportion to the step increase in desired OS. This scenario confirms Sterman's corollary that, while amplification magnitude depends on adjustment times and lags, its existence does not.

Fourth, the orders' amplification is almost quadruple the acquisitions', suggesting that office space suppliers face much larger changes in demand than Office Space does. Although temporary, during its disequilibrium adjustment, orders consistently overshoot construction (Fig. 8), an inevitable consequence of the stock and flow structure. Tenants are innocent, but the office space VCM structure is not.

The top right panel of Fig. 8 shows how the GBA, USF and RSF stocks might respond to a step increase in customer (i.e. tenant) demand. Much like the Office Space and OS Supply Chain stocks, the three proposed square footage stocks gradually adjust to their corresponding new equilibria.

Closer to the reality of office space real estate

Simulating the less-than-perfect reality of office space real estate is simply a matter of feeding-back approved projects into the OS Supply Chain orders. This allows controlling the orders that feed the OS Supply Chain. The minor structural revision entails removing the demolition and gap direct effects on orders. In the revised structure of Fig. 9, only approved projects designated "yes" for project financing translate into office space orders. Accordingly, Eq. 5 of Table 2 also changes to become Eq. 36 of Table 3.

Figure 9 Revised office space real estate sector

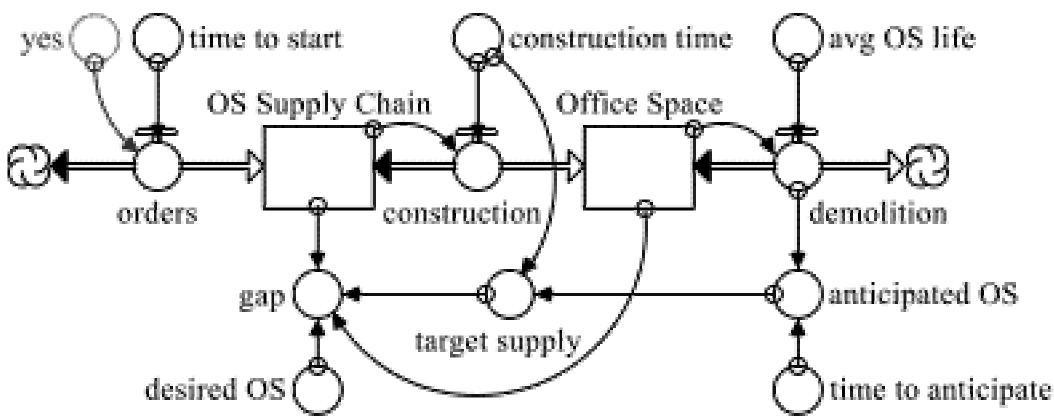


Table 4 Revised OS real estate sector equation

Flow or Rate Variables	Eq. #
orders = max(0, yes / time to start) {Units = sf (square feet)/year}	(5) ~> (36)

Figure 10 shows how this structural change affects the behavior of the Office Space and OS Supply Chain stocks, even without a change in tenant demand (i.e. no step increase in desired OS). On the top panel of Fig. 10, both stocks oscillate wildly, showing a high sensitivity to changes in nnn rent. Although the VCM model structure is for the most part generic, its situation specific parameters produce dynamic behavior patterns similar to the ones Kummerow (1999) and Shilton (1988) see in cyclical office space oversupply data.

In the midst of all these oscillations, one might hardly discern the effects of manipulating the nnn rent parameter in order to combat greed and fee-driven deals when they come into play. It is clear, however, that the higher the nnn rent is, the earlier the cyclical office space oversupply occurs. Apparently, greed and fee-driven deals can push the office real estate cycles to occur earlier than later, allowing potentially corrupt agents and principals to hide behind the opacity of cyclical office space dynamics.

Figure 10 Sensitivity to changes in nnn rent

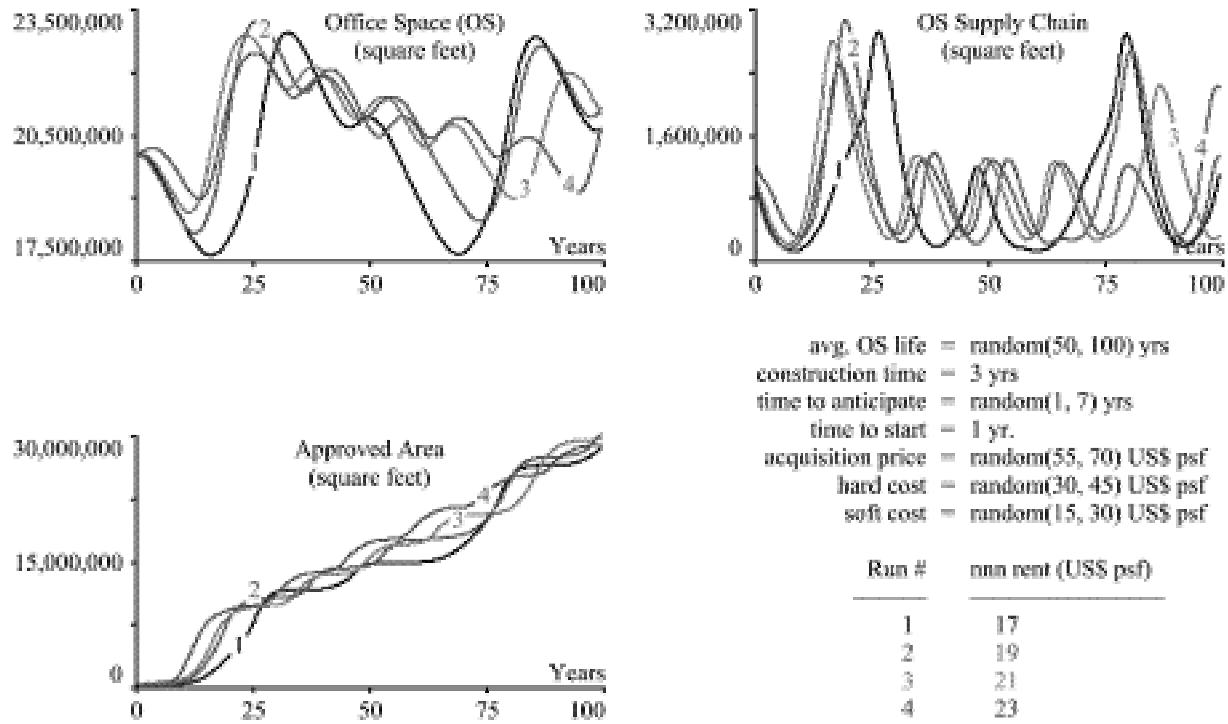


Figure 11 Sensitivity to changes in nnn rent and project cost parameters

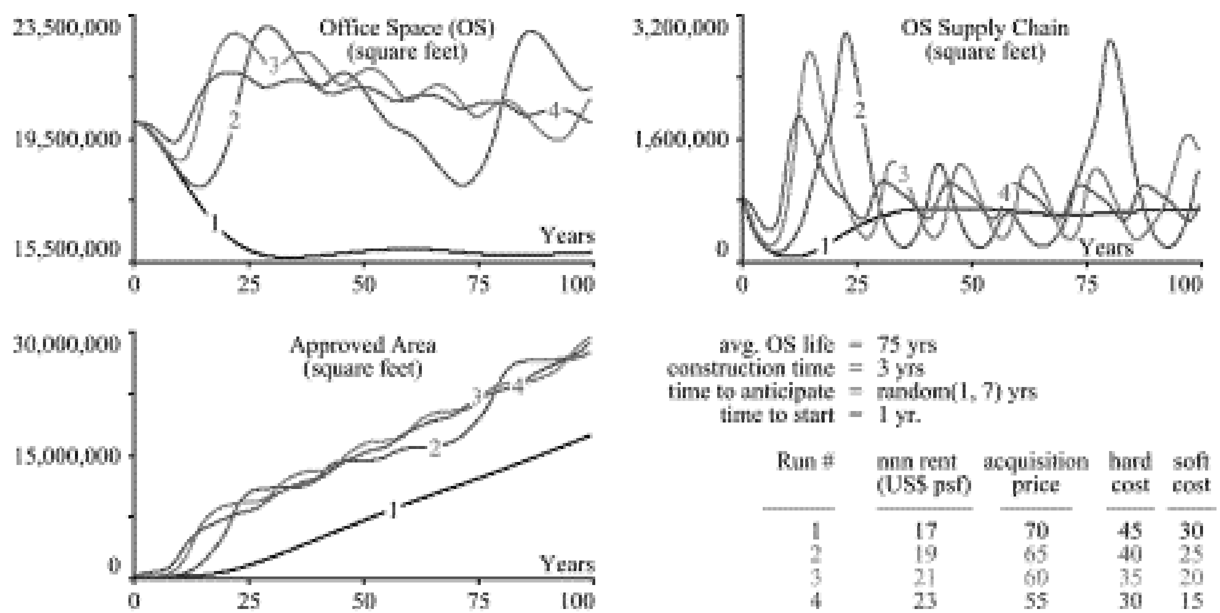
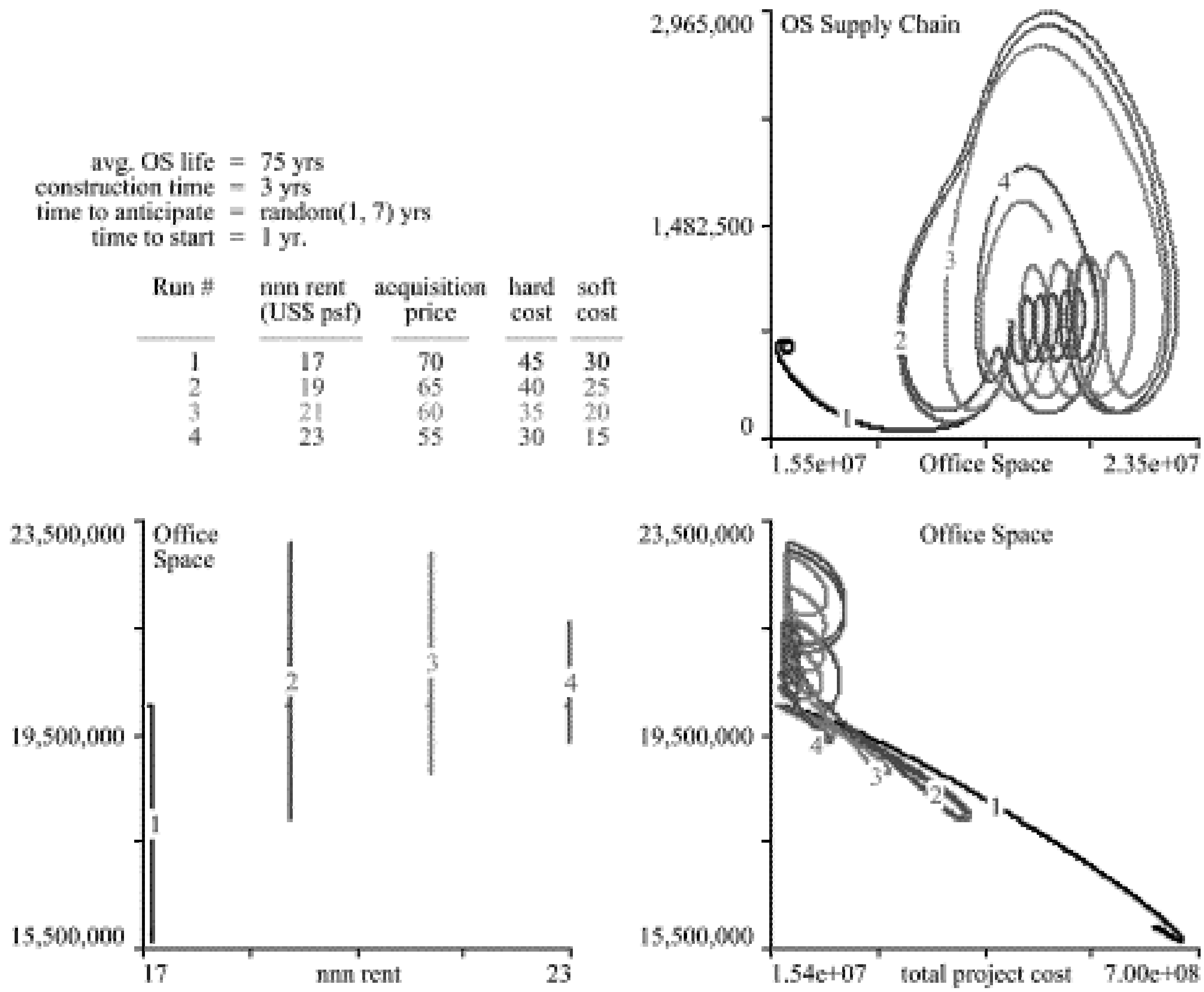


Figure 11 shows the sensitivity of the office space development to changes in both nnn rent and project cost parameters. High project cost parameters (i.e. run #1 of Fig. 11) prevent proposals from being designated “yes” to receive project financing, thereby keeping the office space supply well below its demand of 20 million sq. ft. As pro forma statements move from conservative to optimistic to aggressive project assumptions, however, again the office real state cycles take place earlier than later through time, providing short-term gain to those who seek capital aggressively.

The phase plots on the top right panel of Fig. 12 show how manipulating the projected nnn rent and project cost components moves the office space real estate into cyclical behavior patterns characterized by period doubling and varying phase amplitude. These patterns are similar to those that real estate researchers extract from real life data (Kummerow 1999, Shilton 1988, Sterman 2000). The lower part of Fig. 12 shows the curvilinear net effects of nnn rent (left panel), of total project cost (right panel), and of Office Space, respectively.

Figure 12 Phase plots showing OS sensitivity to changes in nnn rent and total project cost



Initially (run #1 & #2), the higher the projected nnn rent is, the higher the office space oscillation, amplification, and phase lag cycles will be (lower left panel of Fig. 12). Subsequently, however, the increasing nnn rent and more aggressive project cost parameters (run #3 and #4) might lead to a reduction in cycle amplitude.

The phase plot on the lower right panel of Fig. 12 depicts the inverse relationship between Office Space and projected total project cost. The higher the total project cost is, the lower the downside of the cycle attractors are, and vice versa.

Conclusion

Drawing on Plato's allegory on the relation between true being and the illusions of the sense world, this essay explores the complexity of hopes and delusions of transparency (von Furstenberg 2001) in three stages. *First*, nine Deming Scholars (DS-9) use systems archetypes to interpret some of the G7/G8 summit clarion calls for greater transparency in political and military spheres. *Second*, the essay presents a framework for shifting managerial attention from single- and double- to multi-loop learning, a potentially significant requirement for combating greed and fee-driven deals when they come into play. *Third*, using a generic system dynamics simulation model, a hypothetical pro forma example from office real estate development, investment and finance shows how the manipulation of project assumptions (whether attributable to *irrational exuberance*, faulty data or poor forecasts) can significantly affect real estate investment decisions and cause office space oversupply (Kummerow 1999, Shilton 1988, Sterman 2000).

The simulation results confirm that it is probably true of real estate financial valuations, as in deterministic chaos, that minute changes can lead to large deviations in behavior through time, but the dynamics of when and how they do so are, for practical purposes, unpredictable ex ante and even poorly explained ex post. The results show that statistical transparency, though an intermediate good of some value, may never yield the final transparency product people care about in office space real estate development, investment and finance. Perhaps egged on by international and national financial institutions and public agencies that are in the business of gathering and releasing economic statistics in part to serve their own monitoring needs, the G7/G8 summits have tended to promise too much by playing up statistical transparency as the key to reform and to prevent crises in international capital markets.

Given the vicious interplay of systemic fluctuations, attributed in part to underlying stock and flow structures, office space real estate value chains may never render themselves completely analyzable, particularly by statistical techniques designed to assess life's randomness human errors. Even if some endogenous and exogenous variables and parameters remain elusive and unknowable, system dynamics might still help explain that not all unfortunate consequences result from the intransparency of office space real estate cycles. Yet, it is one thing to ignore or to be ignorant of a supply chain's corrective actions initiated but which have not yet had their effect, and quite another to hide behind office space real estate cycles and try to push them to happen early for short-term personal gain. After all, greed is not a virtue Plato might... add.

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