

Enterprise and Parametric Modeling

Decision Support for Strategic Planning of Corporate Real Estate

BY CHARLES A. SHAPIRO, CRE

WHAT WOULD HAPPEN IF A CORPORATE REAL ESTATE department could investigate the impact of regional location, facility ownership and workplace utilization using a single analytical tool?

What would happen if a Corporate Real Estate department could predict the capital budget of a manufacturing company based just on the concept of a new product slated for production 3-4 years from now?

Who would listen to their findings? The Director of Corporate Real Estate? The CFO? The Heads of Manufacturing or R&D? The CEO?

These questions are among those being contemplated as a new generation of computerized models are being developed for the purpose of strategic planning of corporate real estate. The benefits of such models extend far beyond real estate analysis. In fact, the utility of such models may provide a new central role for corporate real estate departments and, as a by-product, yet another justification for centralized control of real estate in large multi-divisional corporations.

As analysts have become more skilled in the use of relational database and spreadsheet programs, and as computer capacity and speed constraints have diminished, new approaches to real estate analysis are being adopted to provide timely support for an ever wider spectrum of corporate executives. In contrast to traditional applications of financial modeling in corporate real estate, these emerging approaches purposely emphasize business needs (or the demand side) of corporate real estate, not just the financial feasibility of alternative supply-side solutions. Rather than simply assuming corporate demand as a given, these models

attempt to derive facility demand as a function of primary business strategies.

Two such approaches are Enterprise-wide Modeling and Parametric Modeling, both of which can be very effective in supporting real estate decisions in the context of broader business strategies, thus giving the corporate real estate executive a seat at some very important conference tables. However, there are practical and conceptual challenges in applying these approaches to corporate real estate. Both approaches are particularly "data hungry," requiring the marshalling of significant amounts of data from diverse sources within a corporation; and both require a focus and deftness with business details typically outside the real estate analysts' comfort zone.

CORPORATE ENTERPRISE-WIDE MODELING

Enterprise-wide Models, by definition, address aspects of businesses far broader than corporate real estate. Such models are defined not only by the breadth of their scope, but by the degree to which they reside within the information sys-

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Exhibit 1

PROS AND CONS OF ENTERPRISE-WIDE MODELING

<u>Model Type / Feature</u>	<u>Benefits</u>	<u>Challenges/Limitations</u>
Embedded Systems	<ul style="list-style-type: none"> - Validity of non-real estate Data assured - Most suitable for real-time monitoring of business 	<ul style="list-style-type: none"> - Difficult to use for off-line planning - Difficult to model numerous alternatives
Facility Mgmt / CAD	<ul style="list-style-type: none"> - Creates Personnel / Assets Linkage 	<ul style="list-style-type: none"> - Typically limited to "before" & "after" comparison
Migration	<ul style="list-style-type: none"> - Migrates Individual Workers 	<ul style="list-style-type: none"> - Difficult to model Re-organization
Workpoint Accounting	<ul style="list-style-type: none"> - Focuses on Allocation of Total Costs to support Worker 	<ul style="list-style-type: none"> - Not oriented toward future projection.
Separated Models	<ul style="list-style-type: none"> - Comprehensive business scope beyond real estate - Enables clear, focused evaluation of "what if" scenarios 	<ul style="list-style-type: none"> - Requires periodic Linkage to Embedded Systems for Validation
Strategic Planning Models	<ul style="list-style-type: none"> - Bi-directional evaluation of: <ul style="list-style-type: none"> > business impact of real estate strategies > real estate impact of business strategies - Product Line, departmental or building group orientation - Future Projection orientation - Gives Corporate Real Estate a seat at the Business Strategy Forum 	<ul style="list-style-type: none"> - Requires thorough understanding of business : real estate relationships - Requires strong relationship with core business strategists - May not be detailed enough for single project authorization
Parametric Models	<ul style="list-style-type: none"> - Stresses cause & effect relationships - Ideal for capital cost or space demand models tied to products - Side benefits of "early" planning for products and facilities - Gives Corporate Real Estate a seat at the Business Strategy Forum 	<ul style="list-style-type: none"> - Requires extensive knowledge of core business - Mostly outside real estate analysis "comfort zone" - Requires strong relationship with core business strategists

tems of a corporation. For purposes of discussion, these can be divided into two types:

- 1) Embedded, having direct real-time linkage to corporate data systems; and
- 2) Linked, less ambitious models using only occasional updates from corporate data systems.

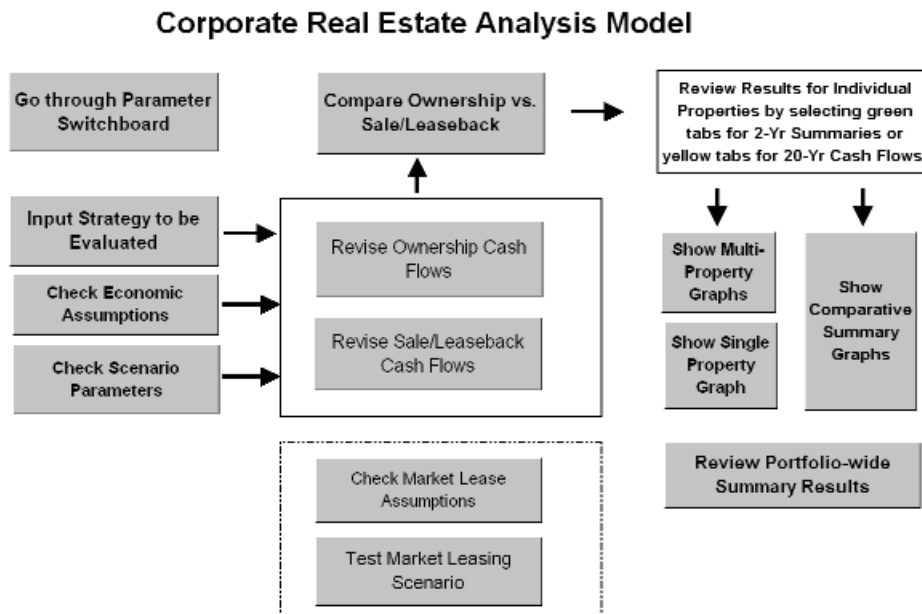
The Embedded form of Enterprise modeling has the built-in validity of using the same corporate data used in the corporation's core business and in other administrative support functions. The Linked form has the benefit

of enabling rapid analysis of "what-if" scenarios. While Enterprise-wide in scope, these separated models can be more compact, not actually manipulating the large volumes of detailed information of an embedded system. It has often been observed that these smaller models are the most effective decision-support tools, with a clarity that is appealing to the highest levels of corporate decision-makers.

In their most embedded form, Enterprise models harness huge amounts of corporate data (including payroll, accounting and purchasing data) directly from corporate

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Exhibit 2
Corporate Real Estate Analysis Model



databases, enabling real-time monitoring of performance. These systems link this compendium of business data to current real estate information, typically using personnel records as the primary linkage. With the worker as the primary data key, everything from floor plans to asset lists (e.g., office equipment) can be linked to specific employees, thus adopting a "workplace accounting" perspective to display a cost breakdown of real estate and other assets necessary to provide each worker with their complete corporate work environment. These applications of Enterprise-wide models can prove especially useful in tracking complicated corporate relocation initiatives or the personnel migration accompanying floor-by-floor or zone-by-zone building re-configuration projects. In these instances, tracking (rather than analysis) becomes the priority, since the complex game of musical chairs typically occurs on an individual worker basis, rather than at a departmental level. Ironically, the pitfall of these ambitious embedded Enterprise-wide models is their very emphasis on real-time data, which often inhibits their suitability for planning purposes (particularly for long-range planning beyond the time horizon of a small project).

SIMPLIFIED ENTERPRISE MODELING

The challenge is to enable modeling that is both enterprise-wide in scope (with potentially direct linkage to real-time data), but with the ability to rise in altitude, so to speak, by modeling workgroups and other teams tied to the products and revenue streams of a corporation. Using commonly available software (such as Access or Excel), one can model a corporation both by lines of business and by groups of locations or buildings. Most importantly, these models can be designed to estimate the need for facilities as a function of product revenue and the personnel required to create and sell those products. This demand-side connection can be most effective in enabling corporate real estate executives to demonstrate, with proper perspective, the role of real estate as a facilitator of the corporation's core business.

Capitalizing on the bi-directional nature of the relationship between business and real estate, these models can be utilized to evaluate:

- 1) the operational business impact of corporate real estate decisions; and
- 2) the real estate impact of business operation decisions.

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Exhibit 3

Corporate Real Estate Ownership Model Parameters

<p>Comparative Modes of Property Ownership</p> <ul style="list-style-type: none"> Owned Sale / Leaseback Market Lease 	<p>For Ownership Scenarios</p> <ul style="list-style-type: none"> Book Value & Depreciation Building Infrastructure Equipment Mortgage Planned Capital Expenditure Office - Bldg CapEx Mfg/Ind - Bldg CapEx Reversionary Sale
<p>Universal Assumptions & Parameters</p> <ul style="list-style-type: none"> Miscellaneous Years of Analysis Discount Rates Corporate Tax Rate Number of Shares Outstanding 	<p>For Market Lease Scenarios</p> <ul style="list-style-type: none"> Market Rates Office Rental Rates Office Lease Terms & Conditions Office Tenant Improvement Allowance Manufacturing / Industrial Rental Rates Mfg/Ind Lease Terms & Conditions Mfg/Ind Tenant Improvement Allowances Property Sale Property Sale Fees
<p>Property-Specific Parameters - All Modes</p> <ul style="list-style-type: none"> Occupancy Expenses For Office & Mfg/Ind: <ul style="list-style-type: none"> Operating Expenses & Growth Rates Utility Expenses & Growth Rates Maintenance / Repair & Growth Rates Real Estate Taxes & Growth Rates For Land: <ul style="list-style-type: none"> Real Estate Taxes & Growth Rates Revenue For Office & Mfg/Ind: <ul style="list-style-type: none"> Revenue & Growth Rates 	<p>For Sale / Leaseback Scenarios</p> <ul style="list-style-type: none"> Corporate Perspective Gross Property Sale Price Tenant Improvement Allowance Transaction Costs & Fees Percentage of Property to be Leased Back LeaseBack Rent, Terms & Conditions <ul style="list-style-type: none"> Third-Party Owner's Perspective Required IRR Expense Ratio Reversionary Sale

For example, one can investigate the impact of changes in the mix of a business's products on corporate revenue, labor requirements, facility requirements (including production and administration) and all of the ensuing expenses of running the business. By designing these models to run in reverse, the overall business impact of specific real estate and facility decisions can be evaluated. These may include the sale/leaseback of existing facilities, the relocation of operations to new locations, or the application of new workplace standards to corporate facilities.

By intentionally including a spectrum of non-real estate variables in the analysis, Enterprise-wide Modeling can go far beyond the more traditional analysis of costs and benefits of specific real estate decisions (such as "own vs. lease," "private office vs. open plan workstation," or "old location vs. new location"). Narrow decision-specific analyses have characterized corporate real estate analysis since the first application of computer technology and the

use of discounted cash flows. By contrast, Enterprise-wide Modeling seeks to create a broader model of the business, in which corporate real estate can be portrayed in its proper context, as a facilitator of business operations, rather than an end in itself.

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Exhibit 4
Manufacturing Parameters

Manufacturing Capital Budgeting Model - Parametric Menu

Product Code	Product Name	1	2	3	4	5	6	7	8	9	10	11	12	13
		Model Change	Vehicle Type	Vehicle Arch.	Vehicle Weight	Welds	Doors	Vehicle Length	Vehicle Width	Vehicle Height	Drive	Complex.	Styles	Alt. Materials
		Major	SUV	BOF	2000 3610 5000	1000 2550 4000	2 5 5	100 118 200	60 80 100	40 70 100	AWD	Medium	1 3 8	Aluminum
Launch Year	Yearly Volumes	Shifts	Crews	Line Rate	Plant Code	Plant Name	Plant Status	Brownfield / Greenfield	Compatibility	Plant Conversion Strategy				

Manufacturing Capital Budgeting Model - Sample Outputs

	Bldg Conversion		Equipment Cost		Tool Cost		Total Capital Expense	Capital PV	PV per Unit	Annual Burden	Annual Burden per Unit	Program Burden	Program Burden per Unit
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2							
Body Shop													
Paint Shop													
GA													
TOTAL PLANT													

New	CAR	BOF	FWD	High	Aluminum
Major	TRUCK	BFI	RWD	Medium	Composite
Minor	SUV		AWD	Low	Other
			4WD		

PARAMETRIC MODELING

Parametric Modeling involves the portrayal of key parameters of a business as a function of multiple independent variables. The most common non-real estate applications of Parametric Modeling have been in cost estimating, where the cost of producing a product are estimated as a function of the specifications of the product. Contractors to NASA and other government agencies employ this technique. The most direct application of Parametric Modeling to real estate involves a variation on this technique, in this case for the facilities of manufacturing companies, in order to estimate capital expenditures required to convert plants and equipment to produce new products. In certain industries, these conversion costs when new products are introduced can be far more significant than the basic cost of bricks and mortar for the original facility.

From a real estate perspective, within the context of broader Enterprise-wide models, Parametric Modeling can estimate changes in specific real estate variables (such as capital expenditures, facility occupancy, income and expense, and transactional proceeds) as a function of corporate operational decisions. Through such modeling, the potential real estate impact of very broad business strategies, such as the addition of new products or lines of business, the elimination of existing products or lines of business, or the outsourcing or relocation of various parts of a business, can be projected.

REQUIREMENTS OF ENTERPRISE AND PARAMETRIC MODELS

Admittedly, the data and analytical requirements of Enterprise-wide and Parametric models can be somewhat more complex than those of traditional real estate analysis. Most notably, they require a willingness to address business parameters well beyond the "comfort zone" of

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Exhibit 5a

Corporate Real Estate Profile: Occupancy

Corporate Real Estate Profile New Strategy Parameters		Occupancy Expense & Building Efficiency							
		Occupancy Exp. & Bldg. Efficiency			Density		Impact of New Strategy - Deltas		
		\$ Pre-tax Occupancy Expense per RSF	Bldg Rental Efficiency (RSF/GSF)	Building Efficiency (USF/GSF)	Density (GSF per Workstation)	Density (GSF per Person)	Change in Personnel	Change in Facility Density (GSF per Person)	Change in Facility Demand (GSF)
Executive	\$60.00 \$34.00 \$0.00	125% 105 75%	100% 70 50%	961.7	961.7	0	0.0	0	\$0
Administration	\$60.00 \$30.00 \$0.00	125% 105 75%	100% 75 50%	250.8	225.7	0	0.0	0	\$0
Sales & Marketing	\$60.00 \$38.00 \$0.00	125% 100 75%	100% 75 50%	336.0	302.4	0	0.0	0	\$0
Product Development	\$60.00 \$25.00 \$0.00	125% 100 75%	100% 70 50%	628.3	596.9	0	0.0	0	\$0
Operations	\$60.00 \$6.00 \$0.00	125% 95 75%	100% 80 50%	342.9	321.5	0	0.0	0	\$0
Total Company	\$16.45	98.1%	76.2%	383.5	357.4	0	0.0	0	\$0
\$50,000,000	\$2,939,300	175,380	178,710			500			
Company Total Revenue	\$5,879								\$0

many practitioners of real estate, including aspects of a corporation's core revenue generation. These may include elements of supply chain, production and sales, as well as expense-side variables such as operational labor expenses, product development costs, raw material cost, and sales and distribution expenses. On the revenue side, while traditional real estate analyses have no problem addressing building revenue and property sale proceeds, Enterprise models often involve the creation of the complete revenue side of a corporation's primary business, including specific product pricing and projections of future sales volume.

The need for such data stems from the goal of Enterprise models to portray a comprehensive view, not only of all aspects of corporate revenue and expenses, but of the sensitivity of performance metrics to business strategies such as outsourcing, supplier integration and after-market revenue potential.

ENTERPRISE SCALE BENEFITS

With the broad scope (and data challenges) of Enterprise-wide modeling come some fundamental advantages, including a high degree of philosophical clarity. While analysts of real estate transactions are often faced with vexing dilemmas regarding the "counting" or "exclusion" of what are commonly described as "shadow costs" and "non-quantifiable impacts," users of Enterprise-wide models generally don't have to qualify their results because, quite frankly, the intent of their models is to "count everything." Impacts felt at the corporate level, which may be "outside the scope" of departmentally defined transaction analyses, cannot be relegated to asterisk status, since the model, by definition, is intended to demonstrate impacts throughout the corporation. When dealing with relocation strategies, the analyst using an Enterprise-wide model need not make special provision to include the impact of vacant space in an abandoned location, since the model is incapable of excluding such costs from the analysis. The watchword of such models is, sim-

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Exhibit 5b

Corporate Real Estate Profile: Density

Corporate Real Estate Profile New Strategy Parameters		Workplace Density					Impact of New Strategy - Deltas							
Use Sample Data for Strategy Clear All Inputs Expense & Efficiency Personnel Economics Workplace Density Summary Fitup Work Patterns		Private Offices as % of total Workplaces	Avg Private Office Size - net USF	Avg Workstation Size - net USF	Offices and Workstations as % of Net USF of all Functions	Circulation as a % of Net USF (Circulation Factor)	Change in Personnel	Change in Facility Density (GSF per Person)	Change in Facility Demand (GSF)	Change in Annual Pre-tax Occupancy Expense	% of Company Personnel	Total Number of Personnel	Density (USF per Workstation)	Density (USF per Person)
Executive		70	500	48	50	50	0	0.0	0	\$0	10	673.2	673.2	
Administration		5	180	48	45	55	0	0.0	0	\$0	90	188.1	169.3	
Sales & Marketing		10	240	48	40	50	0	0.0	0	\$0	25	252.0	226.8	
Product Development		5	180	110	40	55	0	0.0	0	\$0	75	439.8	417.8	
Operations		5	150	48	30	55	0	0.0	0	\$0	300	274.3	257.2	
Total Company		6.6%	197.9	57.6	35.4%	1.55	0	0.0	0	\$0	100.0%	500	292.1	272.3
\$50,000,000			31	435		136,130								
Company Total Revenue			\$2,939,300	\$5,879		175,380				\$0				

ply, "when in doubt, aggregate upward," rather than "when in doubt, cite it with an asterisk."

PARAMETRIC BENEFITS

Commensurate with the additional requirements of Parametric modeling are the additional benefits. All too often, those responsible for real estate and facilities in corporations are relegated to the province of "general services and support." By elevating the analysis of real estate and facilities to include operational impact and, most importantly, corporate revenues, parametric modeling can give corporate real estate executives a seat at a far more important table: that of strategic business planning.

EXAMPLE #1 -PRO-ACTIVE TOOLS FOR PORTFOLIO OWNERSHIP AND DEPLOYMENT

Although discounted cash flow analysis has been a common tool in corporate real estate for decades, it is typically applied to single property transactions. Since decisions often follow guidelines set by corporate treasuries, analyses utilizing spreadsheet templates have sometimes been adopted by corporate real estate departments as a standard approach. All too often, however, the quirks of individual real estate transactions (and sometimes deference to outside brokerage and management firms) have forced

corporate real estate departments to veer away from standardized templates.

The added speed and capacity of personal computers, however, enabled one corporation to adopt a single model, not only as a template, but as a system in which analyses of multiple properties (or the entire portfolio) could be conducted. The "Corporate Real Estate Portfolio Analysis" system developed for this client provides simultaneous cash flow analyses for as many as 25 corporate properties. A single button instructs the model to create cash flows of specified duration (typically 10-25 years) under three different modes of ownership: 1) corporate ownership; 2) sale/leaseback and 3) leasing of facilities on the open market. Within seconds, the model can "assemble" the portfolio, combining groups of owned, leased back, or market leased properties. Both tabular and graphical results are displayed for individual properties, groups of properties and the entire portfolio. Results include 1) real estate metrics (such as Pre-tax and After-tax occupancy expense, expressed as an Net Present Values and annualized as Level Rent Annuities); and 2) corporate metrics (such as impact on earnings per share).

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Exhibit 5c

Corporate Real Estate Profile: Occupancy: Personnel

Corporate Real Estate Profile New Strategy Parameters	Personnel Economics				Work Patterns					
Use Sample Data for Strategy Clear All Inputs	Annual Revenue per Person	Annual Compensation per Person	2nd Shift Wage Premium	3rd Shift Wage Premium	% Personnel On-Site	% of Personnel Telecommuting	% of Workweek Telecommuting	% Dedicated Workstations	% Time away from Workstation	# of Shifts
Expense & Efficiency Personnel Economics Workplace Density Summary Fitup Work Patterns										
Executive	\$200.0 \$100 \$0.0	\$200.0 \$335 \$0.0	2.00 100 1.00	2.00 100 1.00	100% 100 0%	100% 0 0%	100% 100 0%	100% 100 0%	100% 100 0%	3.00 100 1.00
Administration	\$200.0 \$100 \$0.0	\$200.0 \$80 \$0.0	2.00 100 1.00	2.00 100 1.00	100% 100 0%	100% 10 0%	100% 100 0%	100% 100 0%	100% 0 0%	3.00 100 1.00
Sales & Marketing	\$200.0 \$100 \$0.0	\$200.0 \$135 \$0.0	2.00 100 1.00	2.00 100 1.00	100% 100 0%	100% 25 0%	100% 20 0%	100% 75 0%	100% 25 0%	3.00 133 1.00
Product Development	\$200.0 \$100 \$0.0	\$200.0 \$95 \$0.0	2.00 110 1.00	2.00 120 1.00	100% 100 0%	100% 5 0%	100% 100 0%	100% 100 0%	100% 0 0%	3.00 100 1.00
Operations	\$200.0 \$100 \$0.0	\$200.0 \$45 \$0.0	2.00 110 1.00	2.00 120 1.00	100% 100 0%	100% 0 0%	100% 0 0%	100% 75 0%	100% 25 0%	3.00 105 1.00
Total Company \$50,000,000 Company Total Revenue	\$100,000									

The primary purpose of this model is to provide directional guidance and sensitivity analysis to the corporate real estate department. Rather than simply responding to transactions proposed by others, analysts within corporate real estate can immediately investigate "what-if" scenarios as diverse as:

- 1) Selling and leasing back the entire facility portfolio;
- 2) Closing certain locations and either building or leasing facilities in new locations;
- 3) Selling entire facilities but leasing back only portions needed based on changing corporate facility demand; and
- 4) Adopting different strategies for different sub-sets of properties based on their physical characteristics, planned capital expenditures, or the success of certain business units occupying those facilities.

A side benefit of this model is, of course, the standardization of data describing each property, each prospective transaction and each market area in which the corporation currently or potentially operates.

Beyond its use as a property analysis tool, this model can serve as the property module of a broader suite of models dealing with the regional (or global) location of corporate operations. By adding modules on differential labor costs,

distribution costs and regional production goals, one can analyze the costs and benefits not only of property ownership or leasing, but alternative strategies for regional or global re-deployment of certain corporate functions.

EXAMPLE #2 - CAPITAL BUDGETING IN MANUFACTURING

One of the first applications of Parametric Modeling occurred in the real estate-related field of capital budgeting. At a major auto maker, parametric models were derived to provide a pragmatic way of estimating future capital expenditures for plant conversion, installation of equipment and new tooling at auto assembly plants. The independent variables driving these models were the "attributes" of new car and truck models to be assembled, combined with the attributes of each of the company's plants. Through successive work sessions with engineers responsible for more detailed "one-off" estimates, a series of mathematical models was derived for estimation of plant conversion, equipment and tooling, based on key parameters such as the size, structure, features and complexity of the company's products (in this case, cars and trucks). Using these models, capital costs associated with assembling each of the company's existing and planned future products could be estimated for hypothetical production of various volumes at each of the company's plants.

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The resulting model was capable of predicting future capital expenditures for the company's overall product plan under a variety of product : plant combinations. After several months of refinement, these models were capable of providing estimates within 5% of the traditional more detailed methods, based, most importantly, on far fewer attributes of vehicles and plants. The power of doing the accurate estimates with as few attributes as possible has inestimable value to an auto maker, since this allows them to estimate the financial consequences of a new vehicle model very early in the product development process, when the product is still very conceptual. This can greatly accelerate the testing of strategies to deploy new products to various assembly plants, something the previous method of cost estimating didn't allow until several years later, when new products had been completely designed.

As a result of this Parametric Model, which takes product information and applies it to real estate cost estimation, this corporation has made the team of real estate analysts essential participants in its Product Planning Process.

EXAMPLE #3 - WORKPLACE AND OCCUPANCY PROFILE

Summarizing corporate occupancy is the goal of a decision-support tool known as the workplace density, personnel work patterns and occupancy for a multi-divisional corporation. By designing screens composed of "graphic equalizers," the model can be used to test the impact of changing a variety of corporate parameters.

A Base Case, i.e., the current occupancy pattern of each division of the corporation, is used as a basis for comparison. A New Strategy can be designed by changing relevant parameters. The impact on overall occupancy expense, workplace efficiency and other facility performance metrics can be immediately observed. Using this tool, corporate decision-makers can hypothesize different facility strategies for different parts of the corporation and observe their impact on the corporation's bottom line.

The following types of variables are considered by the Parametric Model for each Division of the Corporation:

- Workplace Patterns—e.g., Telecommuting, Hoteling & non-dedicated Workstations
- Workplace Density—e.g., Private Offices vs. Open Plan Workstations vs. Team Spaces
- Support Spaces—e.g., File Storage, Office Equipment, Amenities & Circulation
- Tenant Installations—Since the model is driven by high-level corporate metrics, such as Revenue per Person in each Division, the relative impact of various Real Estate-oriented parameters can be seen in their appropriate context. This affords the corporation an objective and timely view through to assess the potential benefits of corporate relocation, or modification of existing facilities.

CONCLUSION

It should be noted that the goal of models of the type described here is to address comprehensively the types of questions being posed by corporate decision-makers, not to provide the most detailed analysis possible. Rather than creating tools that satisfy the most demanding perfectionist within each part of a corporation, the power of these models is their ability to provide timely directional support for high-level corporate decisions.

One of the primary hurdles of developing and applying Enterprise-wide or Parametric modeling to corporate real estate and planning functions can be the organizational structure of the corporation. These types of models cannot necessarily be recommended for every corporate real estate executive, nor for every corporation, because their effective use requires, by definition, a willingness to look beyond some of the traditional roles of corporate real estate departments. In fact, their value is often best conveyed by demonstration to decision-makers outside those departments. ■