



# Data Driven Decision Making Using Enterprise GIS

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Today, organizations face numerous challenges in using the vast array of facilities data to gain a complete understanding of portfolio performance. As a result, the desired business intelligence is not available to make informed decisions and ensure optimum performance. Enterprise geospatial information systems (EGIS) may be used as a comprehensive solution to gain the insights facilities managers need for more effective decision-making.

## The Data Challenge

*“The constant dilemma of the information age is that our ability to gather a sea of data greatly exceeds the tools and techniques available to sort, extract, and apply the information we’ve collected.”*

*Jeff Davidson, Author and Professional Speaker*

As technology evolved to support facilities management, discrete systems were developed to manage different pieces of information. Due to a rise in complexity, facilities management also became more specialized. Domain knowledge and related information systems became imbedded in divergent departments. Many large organizations now have separate units managing operation and maintenance, construction, real estate, space, environmental, health and safety (EHS), energy and emergency management. Each of these departments manage distinct sets of information. For example, computerized maintenance management systems (CMMS) are typically operated by maintenance departments, while the responsibility for managing CAD floor plans often falls within construction.

The information needed to obtain a complete picture of facilities performance may also rest in systems outside of facilities management. Operating cost information may be housed in an enterprise resource planning system (ERP). In addition to facilities support departments, other internal and external groups are interested in facilities information. Building occupants, information technology, human resources, and business and finance, as well as the C-suite, have an interest in certain aspects of facilities ranging from location of personnel and

equipment to high-level views of performance. External stakeholders including insurers and a host of regulators may have an interest in information such as building valuation, construction type and fire barriers.

Thus, facilities management data now resides in a variety of stove piped systems. Even though they often serve a common business function, these disparate systems do not typically share information with one another. The inability to exchange information across systems often produces different results, challenging facilities managers to account for variances. The knowledge to operate these systems and extract useful information is scattered across departments and work groups. Compartmentalization and lack of interoperability impede managers in their quest to find a *single source of truth* to harness the full power of the information they possess. As a result, the best information is not always available to make decisions. Opportunities for gains in efficiency are overlooked and businesses continue to operate facilities below optimum performance.

Organizations that overcome these obstacles and use data in decision-making realize improved performance. According to a study published by the Harvard Business Review, companies in the top third of their industry averaged 5% higher productivity and 6% higher profitability than competitors due to data driven decision-making.<sup>1</sup> EGIS has the ability to consolidate all key facilities data to serve as the *single source of truth* for the information needed to drive operational and investment decisions.

## Why EGIS?

EGIS is a relatively new technology that has grown in use over the past ten years. It is a software solution that integrates all types of data across numerous systems so that data may be managed, analyzed and readily shared throughout the organization. Like CAD, EGIS manages data in layers that may be controlled to produce visualizations of selected data. Since EGIS integrates spatial and non-spatial data, it is the common denominator enabling the integration of a wide variety of facilities data including maps and floor plans.

Because of its ability to integrate the multiple facets of facilities management throughout its business process areas and data sources, EGIS solves a host of facilities management problems and maximizes return on investment. EGIS streamlines and speeds the access and analysis of data. It may serve as the system of record for selected



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<sup>1</sup> Andrew McAfee and Erik Brynjolfsson, "Big Data: The Management Revolution," Harvard Business Review, 2012

facilities data or it may consume and integrate data from other systems and repositories. Some of the more common facilities management data that may reside in an EGIS are listed below:

- Site Maps Including Utilities
- Floor Plans
- Real Property Inventory
- Space Inventory
- Asset Inventory
- Hazardous Materials
- Fire and Life Safety
- Energy
- Operation and Maintenance
- Capital Planning
- Emergency Preparedness

Nearly all facilities information relates to a location in a map or floor plan. For example, cost centers, space classifications, hazardous materials locations, and fire barrier information make most sense when viewed in geospatial form. A geospatial representation of data is much more powerful than tabular form. It shows valuable spatial relationships that are otherwise not easily communicated. When presented in an EGIS, understanding spatial relationships becomes intuitive. Because of its ability to integrate the full spectrum of facilities data and systems, businesses are increasingly turning to EGIS to bridge the gap between the sea of available data and desired business intelligence.

## Opportunities

Facilities represent the largest capital investment for most organizations. If not properly constructed, maintained and operated, the value of these assets may rapidly erode and the anticipated return on investment may not be fully realized. Opportunities exist across the many facets of facilities management to improve operations and increase returns.

*Today knowledge has power. It controls access to opportunity..."*  
Peter Drucker

## Space

Based on a sample of data from R.S. Means, the following table provides U.S. national average unit costs of construction, excluding soft costs, for three types of facilities.

Building	Unit Cost, \$/SF <sup>2</sup>
Office (1 Story)	\$185.34
College Classroom (2-3 Stories)	\$188.48
Hospital (2-3 Story)	\$318.95

<sup>2</sup> RS Means, *RS Means Square Foot Cost Models*, [www.rsmeans.com/square-foot-models.aspx](http://www.rsmeans.com/square-foot-models.aspx)

Because buildings and the space they provide are so expensive, underutilization carries a high, but hidden cost. Businesses that do not have a firm grasp on available space may invest precious capital constructing new facilities, when the need may be met through reassignment of vacant or poorly used space.

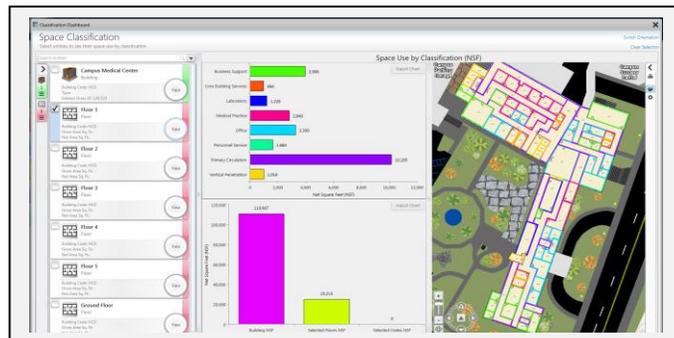
Another way to view this is as a lost opportunity cost. This is the cost of foregone opportunity, if the monetary equivalent of the asset was invested elsewhere. As an example, for a one million-square-foot hospital with two percent vacant space (20,000 SF), using the unit price from above, the vacant space would be valued at \$6,379,000. By applying the 30 year S&P 500 average annual rate of return of 12.5 percent<sup>3</sup>, the lost opportunity cost of the vacant space is \$797,375 per year.

Yet many organizations do not track vacant space. IFMA reports that only eight percent of healthcare organizations track vacant space.<sup>4</sup>

*“What gets measured gets managed.”*  
Peter Drucker

EGIS has the ability to combine all of the data needed to manage space and identify vacancies. EGIS is designed to combine data such as real property information, department assignments, cost centers and space classifications in floorplans that live on a map. Because of its ease of use, EGIS enables the sharing of information formerly limited to CAD users. Its layering capabilities provide discrete views of selected data within the maps or floor plans. Search capabilities enable the user to quickly roll up data from floor to building to campus and portfolio.

By adopting processes to ensure that CAD floor plans are accurate and up-to-date for conversion and upload to EGIS, organizations may rely on the EGIS as the authoritative source for space measurements. This typically requires adopting a consistent space measurement methodology such as that of the Building Owners and Managers Association (BOMA).



Space measurements underpin numerous types of analysis. The gross square feet (GSF) is particularly valuable in normalizing data to produce key performance indicators (KPIs). Normalization is the process of reducing data to common terms in order to make an apples to

<sup>3</sup> MoneyChimp, *Compound Annual Growth Rate (S&P 500: 1985-2015)*, [http://www.moneychimp.com/features/market\\_cagr.htm](http://www.moneychimp.com/features/market_cagr.htm)

<sup>4</sup> IFMA, *2013 BENCHMARKING 2.0 Health Care Facility Management Report*

apples comparison. Key performance indicators enable comparative analysis to gauge facilities performance. The following offers a sampling of common KPIs that are normalized using GSF:

- Utilization Rate = (GSF – Vacant Space) ÷ GSF
- Gross Area per Occupant = GSF ÷ Number of Occupants
- Rentable Area per Occupant = Rentable SF ÷ Number of Occupants
- Efficiency Ratio = Usable SF ÷ GSF
- O&M Staff Intensity = Full Time Equivalent O&M Employees ÷ GSF

The availability of departments, cost centers and space classifications enable additional analysis, such as comparing the amount of space assigned for each respective categorization. This data is also helpful when performing a more detailed analysis after initially identifying an issue using a KPI. For example, if a building has a high Gross Area per Occupant, the next level of analysis could be investigating the space assigned on a departmental basis.

### Energy

Energy is typically a large cost for any organization that owns facilities. According to ENERGY STAR®, organizations that implement an energy conservation program may reduce their energy consumption by up to ten percent, and possibly more.<sup>5</sup> This can translate to significant cost savings. Based on the average annual energy costs reported by IFMA and APPA survey respondents, a ten percent reduction in energy use for a one million-square-foot portfolio will produce the following savings.

Organization	Energy Cost, \$/GSF	Projected Annual Savings
Healthcare	\$3.23 <sup>6</sup>	\$323,000
Higher Education	\$2.15 <sup>7</sup>	\$215,000

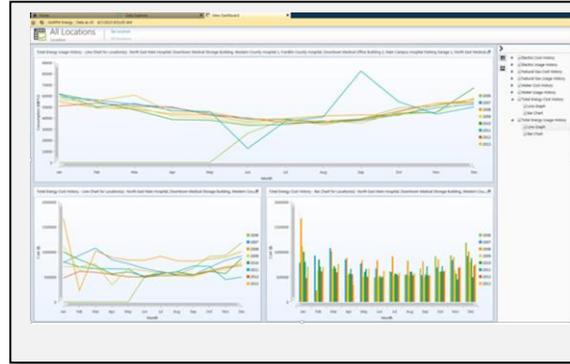
<sup>5</sup> Energy Star, *The Business Case for Energy Efficiency*, <https://www.energystar.gov/buildings/about-us/how-can-we-help-you/build-energy-program/business-case>

<sup>6</sup> IFMA, *2013 BENCHMARKING 2 .0 Health Care Facility Management Report*

<sup>7</sup> APPA, *2012-13 Facilities Performance Indicators Report*

Additional economic considerations incentivize energy conservation. Since global energy demand is expected to increase by 35 percent by the year 2040<sup>8</sup>, prices will continue to rise. Some industries operate on very tight margins. Unlike revenue, savings in operating expenses contribute directly to the bottom line. With average healthcare margins of 2.2 percent<sup>9</sup>, every one dollar of energy savings is equivalent to \$45 in revenue.

Energy data may be analyzed in a number of ways to identify cost saving opportunities. Historic trends are useful in spotting anomalies such as spikes in use and cost. The gross area derived from the floor plans may be used to calculate use and cost intensities, KPIs which may be used to benchmark and compare facilities.



When equipped with an application programming interface (API), EGIS may interface with ENERGY STAR Portfolio Manager<sup>®</sup> to push and pull data and analytics. The EGIS may be used as a platform to post and share KPIs such as ENERGY STAR<sup>®</sup> ratings and reports on greenhouse gas emissions to inform and garner stakeholder support for energy conservation efforts. Available data may also be used to forecast future costs for budgeting.

### Capital Planning

With an aging infrastructure, our nation faces huge backlogs of deferred maintenance. This is indicative of the large investments that will be made to repair, renovate or replace facilities in the years to come. The table below provides a summary of the average age and estimated deferred maintenance for schools, colleges and federal buildings.

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<sup>8</sup> ExxonMobil, *The Outlook for Energy: A View to 2040*

<sup>9</sup> Beth Kutscher, Modern Healthcare, *Hospitals, Systems See Operating Margins Shrink as Expenses Climb* (August 2014)

Organization	Average Age	Deferred Maintenance
Public Schools <sup>10</sup>	40	\$270 Billion
Higher Education <sup>11, 12</sup>	33	\$26 Billion
Federal, Excluding DoD <sup>13</sup>	Not Provided	\$118 Billion

According to APPA, the recommended reinvestment rate for facilities is two to four percent of the current replacement value of facilities annually.<sup>14</sup> Deferring maintenance often increases the ultimate cost. A recent study reported that one dollar of delayed maintenance will eventually require four dollars of expenditures.<sup>15</sup> While most organizations are faced with multi-million dollar capital investment decisions, facility condition indices (FCIs) are not well tracked by all. IFMA reports that FCIs are tracked by only 34 percent of healthcare organizations.<sup>16</sup> Hence, many organizations may lack quantifiable condition and cost information to prioritize needs, and develop capital improvement plans and budgets.

Building areas, including gross area and areas of roofs, are essential data for estimating maintenance and replacement costs. An EGIS may include models to encapsulate condition assessments, and estimate and forecast costs. KPIs in the form of the FCI and extended facility condition index (EFCI) may be used to prioritize investments. The EFCI takes into account the replacement of systems that may have not failed, i.e. not classified as deferred maintenance, but have exceeded their life expectancy.

$$\text{FCI} = \text{Deferred Maintenance} \div \text{Current Replacement Value}$$

$$\text{EFCI} = \text{Deferred Maintenance} \text{ or } \text{Capital Renewal} \div \text{Current Replacement Value}$$

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<sup>10</sup> ASCE, 2013 Report Card for America's Infrastructure, <http://www.infrastructurereportcard.org/>

<sup>11</sup> APPA, 2012-13 Facilities Performance Indicators Report

<sup>12</sup> NACUBO and APPA, *A Foundation to Uphold: A Study of Facilities Conditions at U.S. College and Universities (1996)*

<sup>13</sup> U.S. Department of the Treasury, Bureau of Fiscal Services, 2014 Financial Report of the United States Government, [https://www.fiscal.treasury.gov/fsreports/rpt/finrep/finrep14/supp\\_info/fr\\_supplement\\_info\\_defer\\_maint.htm](https://www.fiscal.treasury.gov/fsreports/rpt/finrep/finrep14/supp_info/fr_supplement_info_defer_maint.htm)

<sup>14</sup> Harvey Kaiser, APPA, *Capital Renewal and Deferred Maintenance Programs (2009)*

<sup>15</sup> SchoolDude, *Deferring Now Costs You Later (2014)*

<sup>16</sup> IFMA, 2013 BENCHMARKING 2.0 Health Care Facility Management Report

When the age of systems and components are known, models may be used to produce a multi-year forecast of capital renewal costs. This information may then be used to create multi-year budgets for long range planning.

## Business Intelligence to Improve the Bottom Line

Once data is consolidated in an EGIS, it may be used to answer key questions such as:

- What facilities do I have?
- What is the cost of operation?
- What opportunities exists for savings?
- What is the condition of facilities and the cost of needed improvements?

This knowledge will aid in making the business case to allocate the necessary resources to sustain facilities and act on opportunities to reduce costs.

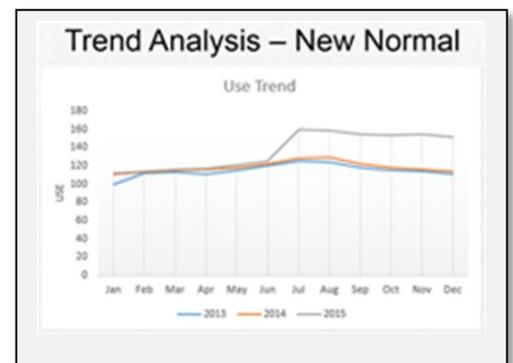
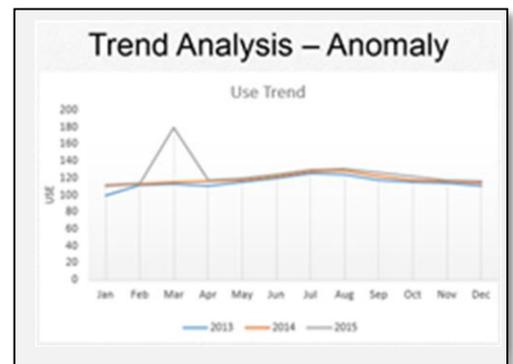
Data from the EGIS may be used to produce analytics to identify deviations that may point to opportunities for savings.

Anomalies such as a sudden spike in energy costs point to the need for investigation. It may lead to the discovery of a leaking water main or malfunctioning HVAC controls.

By comparing trends across years, the EGIS may be used to spot instances where an unchecked anomaly has become the new norm. The date that the new norm occurred may offer clues about the cause of the change. For example, if the organization converted to third shift custodial services on July 1, 2015, the change may relate to custodians leaving lights on throughout the shift. A simple change in operating procedures would reduce the cost.

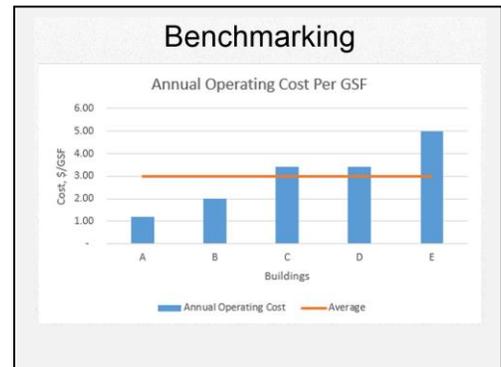
In either example, information is available to calculate the associated cost savings.

Benchmarking may be used to identify poor performing facilities. Again, investigation is required to determine the root cause.



Data should be normalized to compare operating costs, based on dollars per gross square foot. Care should be taken to compare facilities with similar operating requirements. An office building will have a completely different set of requirements than an unconditioned warehouse.

Facilities in a portfolio may be compared to one another or against an average for the portfolio. They may also be compared to other facilities in the same industry. Both IFMA and APPA perform annual surveys of members and report a variety of data that may be used for external benchmarking. ENERGY STAR® scores program participant buildings for comparison to peer facilities.



When selecting KPIs for benchmarking, it is important to choose those that are most relevant to your industry. KPIs must be measurable and the organization must be committed to collecting the required data. Most KPIs require normalization and, in some instances facilities categorization, to produce meaningful comparisons. Industry professional organizations may offer guidance in selecting KPIs and serve as a source for comparative data.

## Sharing the Wealth of Knowledge

Because of its ease of operation, almost everyone in an organization could be trained to use an EGIS. A wide variety of information may be shared with any of a number of facilities stakeholders. Maintenance technicians may access the EGIS to retrieve PDFs of posted construction and renovation drawings for use in troubleshooting. An energy manager may use it to track and report the progress of an energy conservation program. A facilities director may use the EGIS to analyze needs and prepare budgets for capital improvements. The C-suite may be interested in snapshots of performance.

However, an organization may wish to limit views or edit access of selected data. Roles and permissions may be employed to provide the desired control of data. For example, a building manager may be limited to views of data for his or her building while the vice president of facilities would be granted access to all facilities. Some users may desire access to limited sets of data. An EHS manager may be interested in views of hazardous materials locations, but may have no desire for operation and maintenance data.

An EGIS may present data in automated reports and employ models to transform data to more insightful information. The EGIS may also be used to produce dashboards to provide high level views or performance, using KPIs or other critical pieces of information. The reports and dashboards may be shared with stakeholders throughout the organization.

## Key Features

When selecting an EGIS, it is important to consider the features required to support the business needs of the organization. Software features may vary widely among vendors, so it is necessary to not only possess knowledge of the organization's needs, but to also have familiarity with features of potential software.

A configurable and readily scalable architecture offers the greatest flexibility for adapting to the organization's unique data sets and hierarchy. The ability to easily add data sets over time after the initial implementation is essential for growing the EGIS.

To provide efficient Enterprise functionality, the EGIS must be capable of importing data from a variety of external sources. An EGIS with an Application Programming Interface (API) may be leveraged to provide seamless integration for the exchange of information with other applications supporting this feature. The ability to configure the software to support the batch upload of documents and photographs is also highly desirable.

The EGIS must have the capacity to support the desired granularity of data. Room level data associations are valuable for managing a host of data including room numbers, room names, room area, department assignment, cost centers, space classifications and more.

Since all users will not need and may not desire access to all information, controlling views of data and edit access through roles and permissions is critical to effectively use the EGIS across the organization.

## Getting Started

Employing a crawl-walk-run approach in implementing an EGIS offers many advantages. This pathway permits organizations to gain a clear understanding of the business processes and standards required to support the software. It enables organizations to quickly begin use of the EGIS and potentially spread the cost over multiple years.

An incremental approach may consist of first placing basic real property information on a map. Floor plans and associated data may be added in the second step. As a third step, desired analytics may be incorporated in the EGIS. Organizations may also start small, by implementing the EGIS as a proof-of-concept project for a small set of facilities.

Once the EGIS is operational, additional data sets and systems integration may be added over time to continue to grow this enterprise solution. With proper planning, an EGIS may serve as a strategic planning tool that may be used across the organization to manage operations and guide facilities investment decisions to improve the bottom line.

## R&K Solutions

Established in 1984, R&K Solutions is a leading global provider of facilities professional services and software. R&K offers GoRPM<sup>®</sup>, its enterprise GIS facilities management software, as a configurable solution supporting features described in this document. For more information on GoRPM, please visit <http://www.rksolutions.com/gorpm/> or contact R&K at 1-877-753-6486 or [sales@rksolutions.com](mailto:sales@rksolutions.com).

## About the Author

William Wingfield serves healthcare, higher education and governmental clients as a project manager and facilities subject matter expert for R&K Solutions. He holds a Bachelor of Science degree in Mechanical Engineering and an MBA. Mr. Wingfield also completed the SACUBO College Business Management Institute, as well as programs in leadership, finance and real estate. He has more than 30 years of experience managing facilities and operations as a director or executive manager.

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