Financial Applications of Self-Service ETL and Geospatial Analysis

Paras Gupta, Director, BI & Advanced Analytics
8th November, 2019
BGIS provides a full range of consulting, management and delivery services for occupiers of real estate to improve their business performance

Committed to sustainability, innovation and cost reduction within technical real estate portfolios

340M+ Sq.ft. under management
$2.5B Managed spend
$100M Operating cost savings annually
40,000 Locations served
7,000+ Team members
27 Years In operation

FACILITY MANAGEMENT | PROJECT DELIVERY SERVICES | PROFESSIONAL SERVICES | WORKPLACE SOLUTIONS | REAL ESTATE SERVICES
<table>
<thead>
<tr>
<th>FACILITY MANAGEMENT SERVICES</th>
<th>PROJECT DELIVERY SERVICES</th>
<th>WORKPLACE SOLUTIONS</th>
<th>PROFESSIONAL SERVICES</th>
<th>REAL ESTATE SERVICES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advisory, Management &amp; Delivery</strong></td>
<td><strong>Advisory</strong></td>
<td><strong>Advisory</strong></td>
<td><strong>Advisory</strong></td>
<td><strong>Advisory</strong></td>
</tr>
<tr>
<td>Facility Management</td>
<td>Project Planning &amp; Feasibility</td>
<td>Workplace Strategy</td>
<td>Sustainability Programs</td>
<td>Portfolio Strategy Support</td>
</tr>
<tr>
<td>Critical Environments (GCET)</td>
<td>Annual Capital Program Development</td>
<td>Workplace Utilization</td>
<td>LEED &amp; WELL Programs</td>
<td></td>
</tr>
<tr>
<td>Financial Mgmt. &amp; Reporting</td>
<td>Program Management</td>
<td>Workplace Mobility</td>
<td>BCAs &amp; Capital Planning</td>
<td></td>
</tr>
<tr>
<td>Building Operations</td>
<td>Project Management</td>
<td>Etc.</td>
<td>Energy</td>
<td></td>
</tr>
<tr>
<td>Maintenance &amp; Repair</td>
<td>Fit-ups, Renovations, Building Infrastructure Projects, New Builds</td>
<td>Etc.</td>
<td>Waste &amp; Water</td>
<td></td>
</tr>
<tr>
<td>Mobile Technician Services</td>
<td>Etc.</td>
<td></td>
<td>Efficiency Assessments</td>
<td></td>
</tr>
<tr>
<td>Installation &amp; Roll outs</td>
<td></td>
<td></td>
<td>Management &amp; Delivery</td>
<td></td>
</tr>
<tr>
<td>Etc.</td>
<td></td>
<td></td>
<td>Turnkey Energy Retrofits</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>Commissioning &amp; Retro</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Commissioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Assess Engineer Install</td>
<td></td>
</tr>
<tr>
<td><strong>$800M+ FMS Subcontracted Annually</strong></td>
<td><strong>$1.3B+ Projects Managed Per Year</strong></td>
<td><strong>4,700 MAC’s Annually</strong></td>
<td><strong>1,000+ Building Condition Assessments/Year</strong></td>
<td><strong>1,000 Transactions per Year</strong></td>
</tr>
<tr>
<td><strong>&gt;1M Work Orders Annually</strong></td>
<td><strong>15,000 Projects Per Year</strong></td>
<td><strong>2,000 Space Plans Annually</strong></td>
<td><strong>100+ Energy Retrofit Programs Per Year</strong></td>
<td><strong>9,000+ Leases Managed</strong></td>
</tr>
<tr>
<td><strong>1,500 Technicians 475 Mobile Techs</strong></td>
<td><strong>Office, Retail, Critical Facility</strong></td>
<td><strong>300,000 Drawings Under Management</strong></td>
<td><strong>41,000 Utility Accounts Managed</strong></td>
<td><strong>$1.4B Rental Payments Managed</strong></td>
</tr>
</tbody>
</table>
Licenses are expensive

(list) object cannot be coerced to type 'double'

Error: invalid subscript type 'list'

Error: undefined columns selected
Podcasts can be useful

Licenses are expensive

2018
Zero to ‘Advanced’ in 2 weeks

Podcasts can be useful

Licenses are expensive

2018

Thank You!
Kathrin Melcher
Rosaria Silipo
First KNIME Use Case

Pre-retrofit

<table>
<thead>
<tr>
<th>Term</th>
<th>In/Out Of Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>cell, height, standard, fluoresc</td>
<td>IN</td>
</tr>
<tr>
<td>ladder, bring, fluoresc, bulb</td>
<td>IN</td>
</tr>
<tr>
<td>fluoresc, main, burnt</td>
<td>IN</td>
</tr>
<tr>
<td>burnt, fluoresc, cell, ladder</td>
<td>IN</td>
</tr>
<tr>
<td>washroom, burnt, fluoresc</td>
<td>IN</td>
</tr>
<tr>
<td>walk, burnt, caller, bo</td>
<td>UNIDENTIFIED</td>
</tr>
</tbody>
</table>

Post-Retrofit

<table>
<thead>
<tr>
<th>Term</th>
<th>In/Out Of Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>cover, fall, fixtur</td>
<td>OUT</td>
</tr>
<tr>
<td>cell, height, standard, burnt</td>
<td>UNIDENTIFIED</td>
</tr>
<tr>
<td>foot, cell, site, lobby</td>
<td>UNIDENTIFIED</td>
</tr>
<tr>
<td>pot</td>
<td>OUT</td>
</tr>
<tr>
<td>ladder, fluoresc, cell, walk</td>
<td>IN</td>
</tr>
<tr>
<td>washroom, fluoresc, burnt, tube</td>
<td>IN</td>
</tr>
</tbody>
</table>

WO Creation Rel to Install Date (Months)

In/Out Of Scope
- IN-SCOPE
- OUT-OF-SCOPE
- UNIDENTIFIED

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## Finance Innovation Challenge

**Automate one of your most critical time consuming tasks - with KNIME**

<table>
<thead>
<tr>
<th>Project</th>
<th>Features</th>
<th>Time Saved (annualized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheque Payment Reconciliation</td>
<td>✓ Fuzzy matching</td>
<td>~ 2 months</td>
</tr>
<tr>
<td>Financial Reporting Automation</td>
<td>✓ Self serve data preparation</td>
<td>1 month</td>
</tr>
<tr>
<td>Monthly Client Invoicing</td>
<td>✓ BIRT</td>
<td>1 month</td>
</tr>
<tr>
<td>Financial Data Consolidation</td>
<td>✓ Large data volumes</td>
<td>2.5 weeks</td>
</tr>
<tr>
<td>Purchase Order Accrual Automation</td>
<td>✓ Human in the loop</td>
<td>1 week</td>
</tr>
</tbody>
</table>

- **Cheque Payment Reconciliation**
- **Financial Reporting Automation**
- **Monthly Client Invoicing**
- **Financial Data Consolidation**
- **Purchase Order Accrual Automation**

### Time Saved

- ~ 2 months
- 1 month
- 1 month
- 2.5 weeks
- 1 week

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**Podcasts can be useful in 2 weeks**

**Licenses are expensive**

**Zero to ‘Advanced’ in 2 weeks**

**Competitions drive innovation in 2018 and 2019**
KNIME [naim]

verb (used with object), naim•ed, naim•ing

To use KNIME to automate a process

‘I wish I could KNIME my morning routine’

‘Just KNIME it’

‘Do not disturb. KNIMing.’

KNINJA [nin – juh]

noun, plural knin•ja, knin•jas

(often capital letters) a member of a team trained in the art of using KNIME to elegantly automate processes, and efficiently analyze ridiculous amounts of data

‘KNINJA to the rescue!’

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2018

2019

Competitions drive innovation
Competitions Drive Innovation: Creativity!

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2018

Zero to ‘Advanced’ in 2 weeks

2019

Competitions drive innovation

KNI-NJA

KNIME

KABOOM
KNIME Installations

- 150+ users trained
- 20 KNINJA’s
- Cross-departmental training started

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Zero to ‘Advanced’ in 2 weeks

2018
2019

Financial Applications

Competitions drive innovation
Podcasts can be useful
Financial Applications

Centralization
Auditability
Automation
Fun!
Continuity
Time Savings

Scalability
Error Reduction
Financial Applications – Quantify HVAC Retrofit Energy Savings

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Financial Applications

2018

2019

Competitions drive innovation

RTU Only - Comparison pre-post by day of week

RTU Only - Comparison by Day

RTU Only - RTU Inst Comparison Overall

Pre-HVAC Install Regression

Post-HVAC Install Regression

Pre- and post- install for savings

*RTU = Roof-top (HVAC) unit
## Financial Applications

<table>
<thead>
<tr>
<th>Problem</th>
<th>KNIME Application and Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantify savings from work order bundling</td>
<td>SQL ETL, analysis and projected savings calculated based off an approved ‘bundle’ definition</td>
</tr>
<tr>
<td>Decentralized work order accruals</td>
<td>Process standardized across 15+ clients, saving 3 weeks on an annualized basis</td>
</tr>
<tr>
<td>Manual scheduling processes</td>
<td>KNIME scheduling tool enables dynamic rescheduling and real-time updates</td>
</tr>
<tr>
<td>Complex project close-out process</td>
<td>Automation in KNIME enabled quicker close-out processes, improving cash inflows</td>
</tr>
<tr>
<td>Manual billing process</td>
<td>Automation in KNIME drove time savings, error reduction and cash impacts</td>
</tr>
<tr>
<td>Large payable claim</td>
<td>Fuzzy matching of addresses against claim provided decision support to settle claim fairly</td>
</tr>
</tbody>
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Financial Applications
Build It … and They Will Come!

BIRT Invoicing

Global Training

Collaboration

KNIME Server
Productionizing data science applications and services.

Big Data

KNIME Software on Microsoft Azure
Data science cloud deployment.

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Financial Applications

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Competition drive innovation

Build it… and they will come

2018

2019

2020
• **Business Question:**
  – Which market presents the best opportunity for BGIS to expand its service offering (for a specific line of business)?
  – Within that market, which areas should be targeted?

1. **Collect data**
   – Exploratory / R&D data gathering
   – Market data is expensive to purchase – limited budget

2. **Clean the data**
   – Create consistency: Addresses are not always captured the same way
   – Prioritize: Some sources are more important than others e.g. BGIS existing service sites have unique information
   – Remove duplicates: Small differences in latitude / longitude lead to duplicate site records

3. **Perform geospatial analysis**
   – Geospatial tools can be pricey, complicated to learn, and computationally heavy
   – Tagging a site to a geospatial polygon is not a common feature in visualization tools

4. **Create business-user friendly interface**
   – Decision makers require easy-to-understand, yet flexible, interfaces
   – Dollars and cents drive decisions

5. **Iterate, and enhance**
Step 1: Collect data

- Geocode site addresses using Google API: Address => Lat/Long
- Use Google API to get other potential sites by province (daily API cap)
Step 2: Clean the data: Harmonize and Prioritize

- Harmonize data format for analysis
- More robust data sources are prioritized over those with missing data elements
Step 2: Clean the data: Duplicate Removal

- Eliminate duplicate sites caused by small latitude / longitude differences
- DBSCAN Clustering Algorithm with 40m proximity (Haversine distance) creates clusters
- From clusters, select the highest priority data source
  - i.e. the source with the best data quality / integrity. BGIS incumbency flag is implied from other (duplicated) sites, as needed
Step 3: Tag Sites to Geospatial Polygons

- To calculate the market penetration, need to tag sites to the appropriate market

- Geospatial problem: tag site’s latitude / longitude to the appropriate polygon from a (.shp) shape file
Step 4: Business-Friendly Output

- Enable the business to answer its own questions by consolidating output in Tableau.
Conclusion

• What an exciting journey!
  – 15 months since first use case
  – 10+ internal training sessions, 20 KNINJAs

• Change can be challenging and requires some ingenuity
  – Solve well understood problems first, using basic nodes
  – Healthy competition can work – ramp as a group

• Engage senior leaders early with compelling use cases
  – Top-down approach drives a ramp-up which may not happen organically
  – Leaders are happy to spread the knowledge!

• Dramatic results, newfound excitement, and a change in approach
  – Time savings, improved auditability, and centralization are within reach of every problem
  – Talent prerequisites are evolving

• Each new problem generates a greater understanding of KNIME functionality
  – Hundreds of applications
  – More to come!
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noun, plural kninjas
(often capitalized)
a member of a
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Director, BI & Advanced Analytics