Adapting Oil and Gas Data Strategies for CO$_2$ Sequestration*

Jess B. Kozman[1] and Kandy Lukats[2]

[1]Geophysics, CL Tech Consulting, Houston, TX (jkozman@cltechconsulting.com)
[2]3-GiG, Houston, TX

Abstract

As regulatory regimes evolve to encourage carbon footprint reductions in different political jurisdictions with either tax incentives or cap and trade systems, industries that are point sources of CO$_2$ such as power plants, cement kilns and landfills will have a need for evaluation of saline reservoirs for CO$_2$ sequestration potential. In general these are industries that do not currently have geologic reservoir modeling technology, personnel, or expertise, and various academic and industry consortia and commercial ventures are rushing to fill the gap. The types of data required to evaluate a reservoir as a potential CO$_2$ repository have parallels in the exploration, development, and production phases of the oilfield life cycle. Thus the opportunity for knowledge transfer and leveraging of best practices and lessons learned from data management should be similar to that seen when large numbers of oil and gas geologists left the hydrocarbon extraction industries in the mid-1980's and began to apply their experience with data modeling techniques and data flows to environmental projects. Industry standard data models, data exchange formats and integrated workflows that have evolved over the last decades to support exploration and production processes are well positioned to be exploited by this new "green" segment of the energy industry. This paper examines the applicability of some available geological data models, exchange standards and work flow solutions to CO$_2$ sequestration projects.

Partnering with

to bring you world class
Business Information Solutions

2010 Annual Convention & Exhibition • 11-14 April • New Orleans

Adapting Oil and Gas Data Strategies for CO2 Sequestration

Jess B. Kozman, Principal Consultant, CL Tech
Kandy Lukats, President & CEO, 3-GiG

Helping You Organize Your Proprietary Business Information

Challenges for Oil and Gas Data Management

Too much time expended looking for and managing data

"Line of Sight" for management on technical field operations

Non-standard processes and information in discipline silos

Lack of consistency across organizational units and assets

Final results of many studies never captured, knowledge lost

No quality methodology for what is good or clean data

Data version control for real-time operations

No single source of the truth for validated data

No way to create a life of asset story over time

Same information duplicated in multiple places

No way to bring new people up to speed quickly

Disconnect between business and technical systems

Drivers for Managing Data

1) Financial – Decision support and risk management for site characterization, injection technology, and storage modeling.

2) Regulatory – Leverage common data delivery methodologies across multiple reporting agencies and jurisdictions.

3) Public Opinion – Provide science-based information about operations and their environmental impact

Doesn't this sound familiar?

Data Management Lifecycle for CO2 Projects
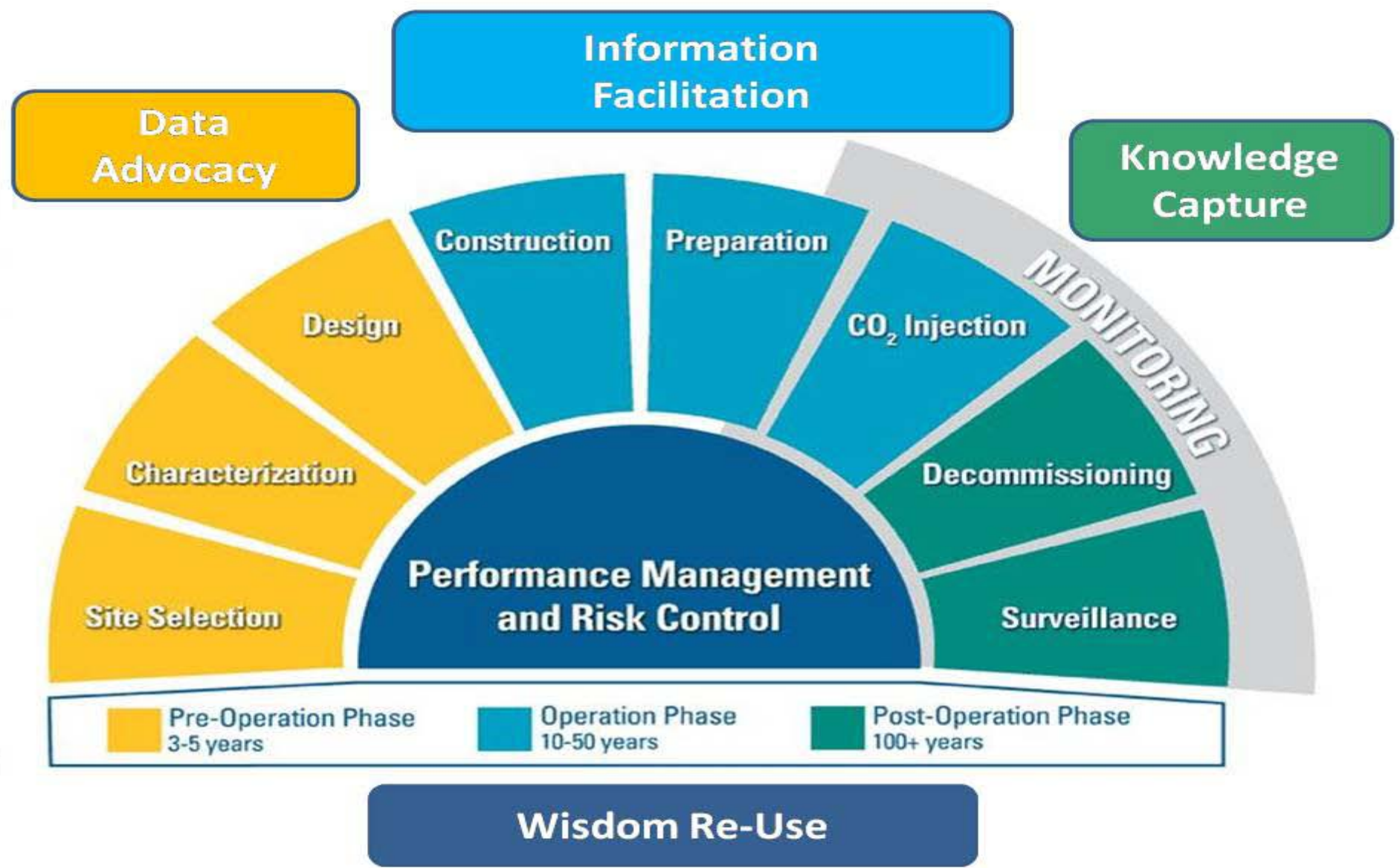
The Problem:

What don't we know?

Geological Storage Timeline
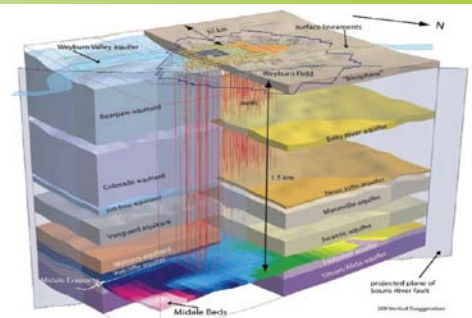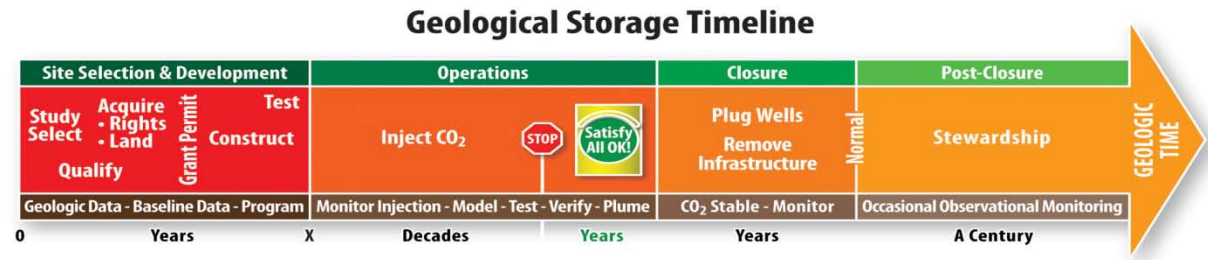
Usable Storage Capacity Volume

What data is required:
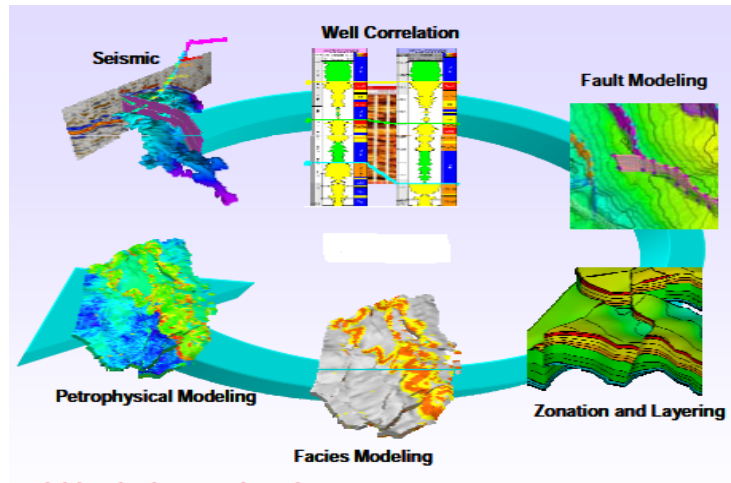
Where is the Information Stored?:

Documented Processes:

Exploration Inventory	Drilling Planning	Execution/Results	Monitoring	Workover	Abandon
Land Position Technical Workflows Economics Risk/Reserves Regulatory Pre-Spud Costs	Budget Timing Risk/Reserves Cost Design Facilities Permits	Cost Timing Execution Monitoring Results Look back	Cost Monitoring Planning Timing Reserves	Budget Timing Risk/Reserves Cost Design Facilities Permits	Cost Permits Environ Timing Results

Non-Producing   Scope   AFE   In Progress   Abandon

Exploration

Lead → Prospect → Scope → AFE → In Progress → Spud → Discovery

Appraise   Produce   Optimize

Idea → AFE → In Progress → Spud → Producing → Scope → AFE → In Progress

Develop   Produce   Optimize

Supporting Technology

| Drilling | Production | Scheduling | Economics | AFE's | Seismic | Well Files | GIS | Doc. Mgmt | Portfolio | Dashboard | Land |

Sequestration as a Business Segment:

Five progressive stages of increasing Data Management Capability and maturity
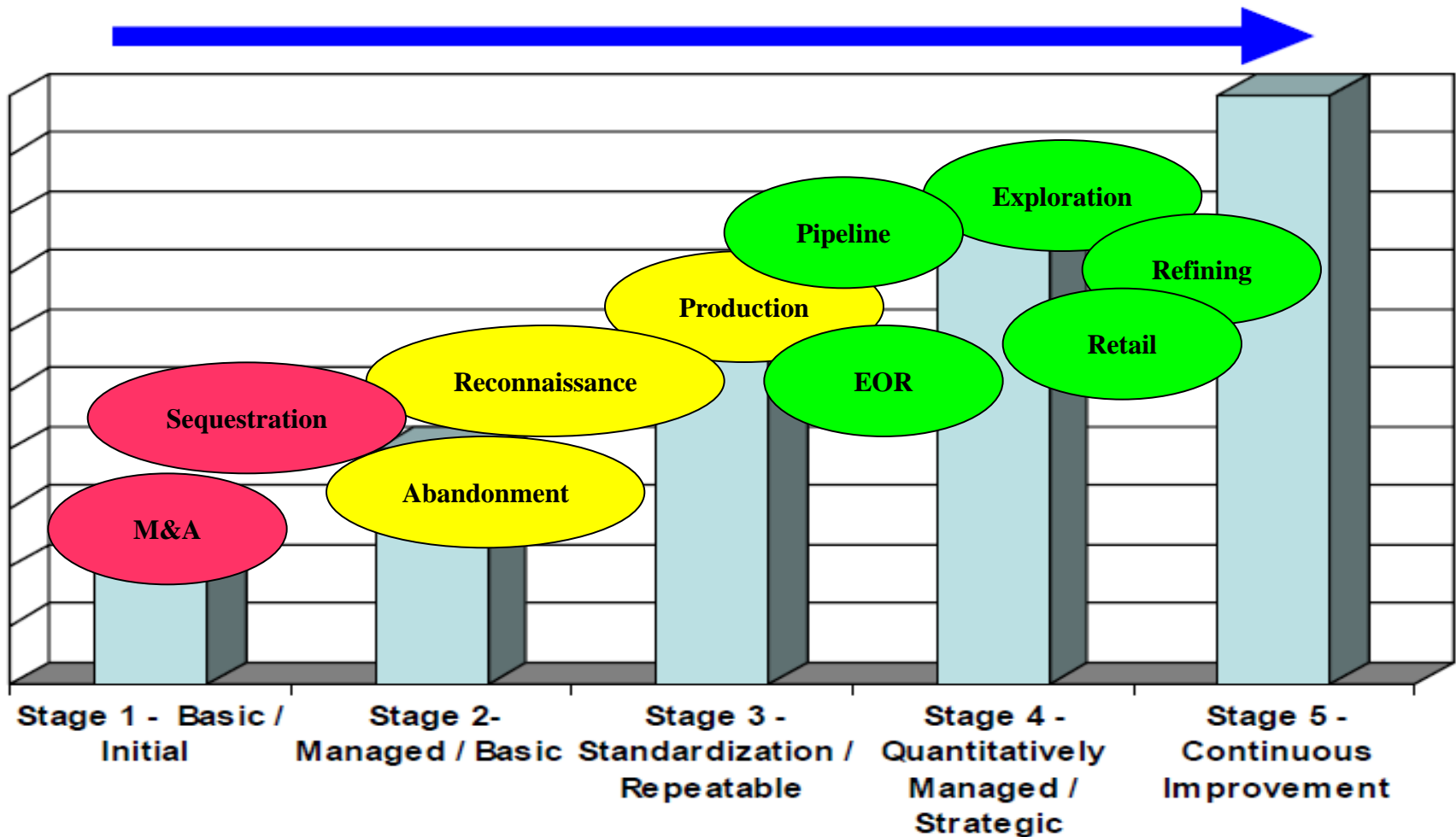
Data Volumes will Drive Adoption of Standards:

CO₂ surface flux using mobile chambers, eddy covariance, and dipole laser technique		Subsurface pressure and temperature **23 data channels / well** **8 GigaBytes /month**
Soil gas sampling		
Shallow groundwater composition		Downhole well logging **17,635 high-resolution TIFF files, volume = 553.34 GigaBytes**
Introduced (PFTs) and natural (isotopes) tracers		Vertical seismic profiling and cross well seismic imaging **168 GigaBytes / model**
		Electrical and electromagnetic techniques **1.2 GigaBytes / 1000 m log**

Data at Multiple Time Scales
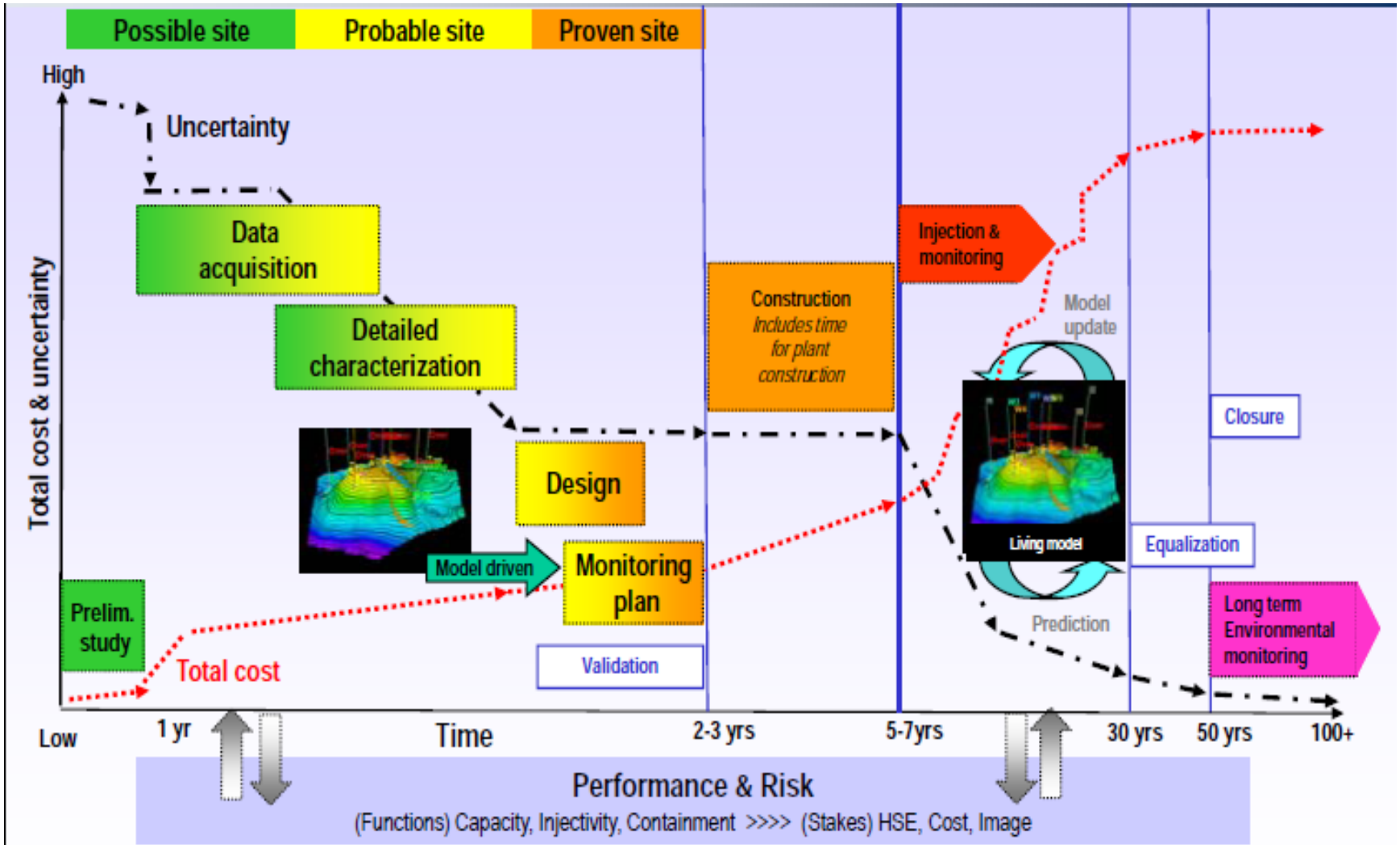
Data at Multiple Dimensional Scales

(Johnston and Terrell, 2006)
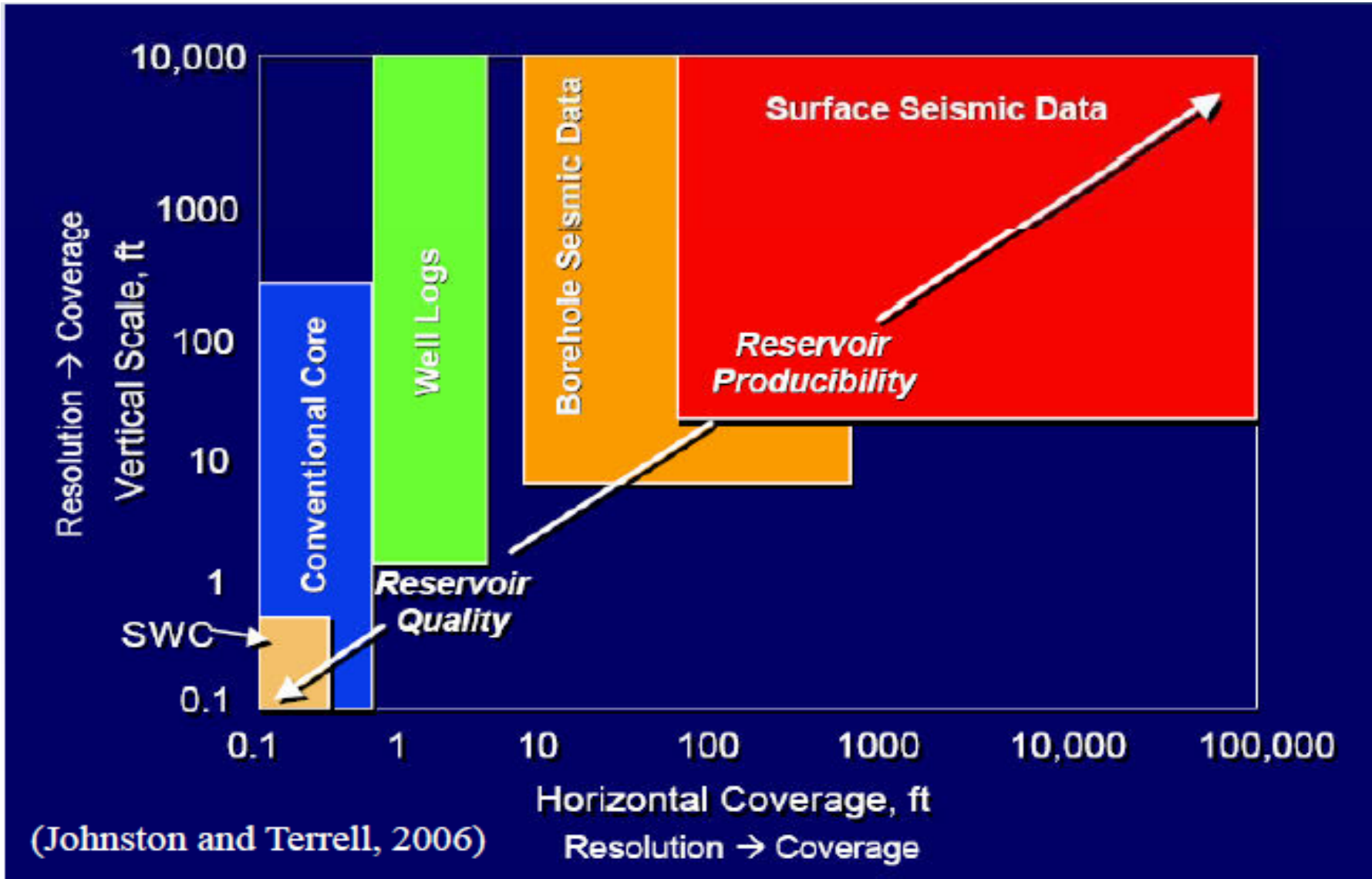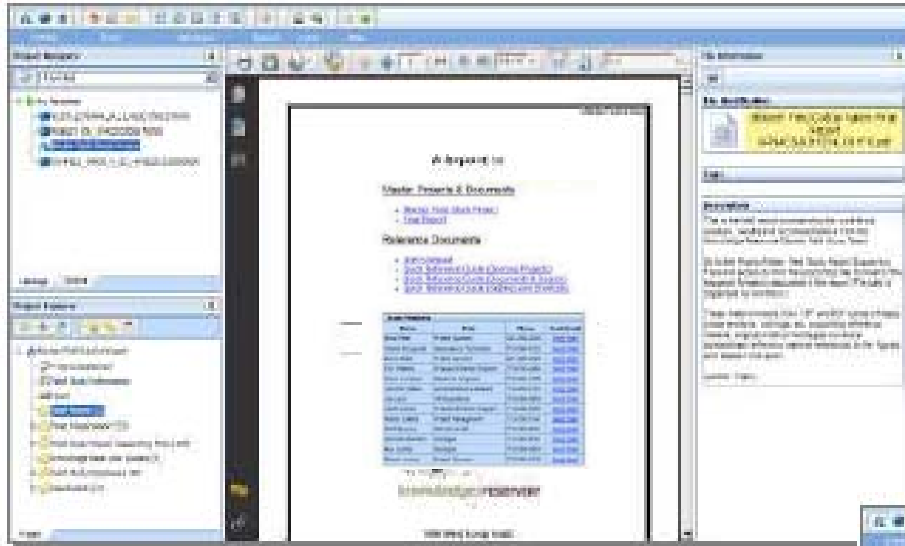
A Case Study:

Searches by organizational hierarchy

Filter by data elements used in the workflows

PPDM back end and workflow application

Inventory and delivery of field study results
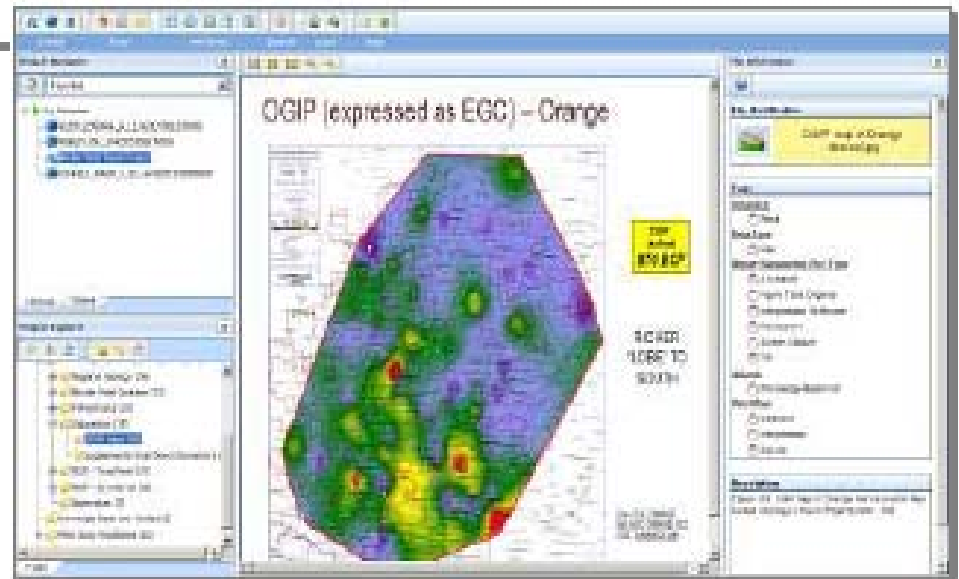
A Case Study: Field Study Delivery

Configurable Solution Features

Example Workflow
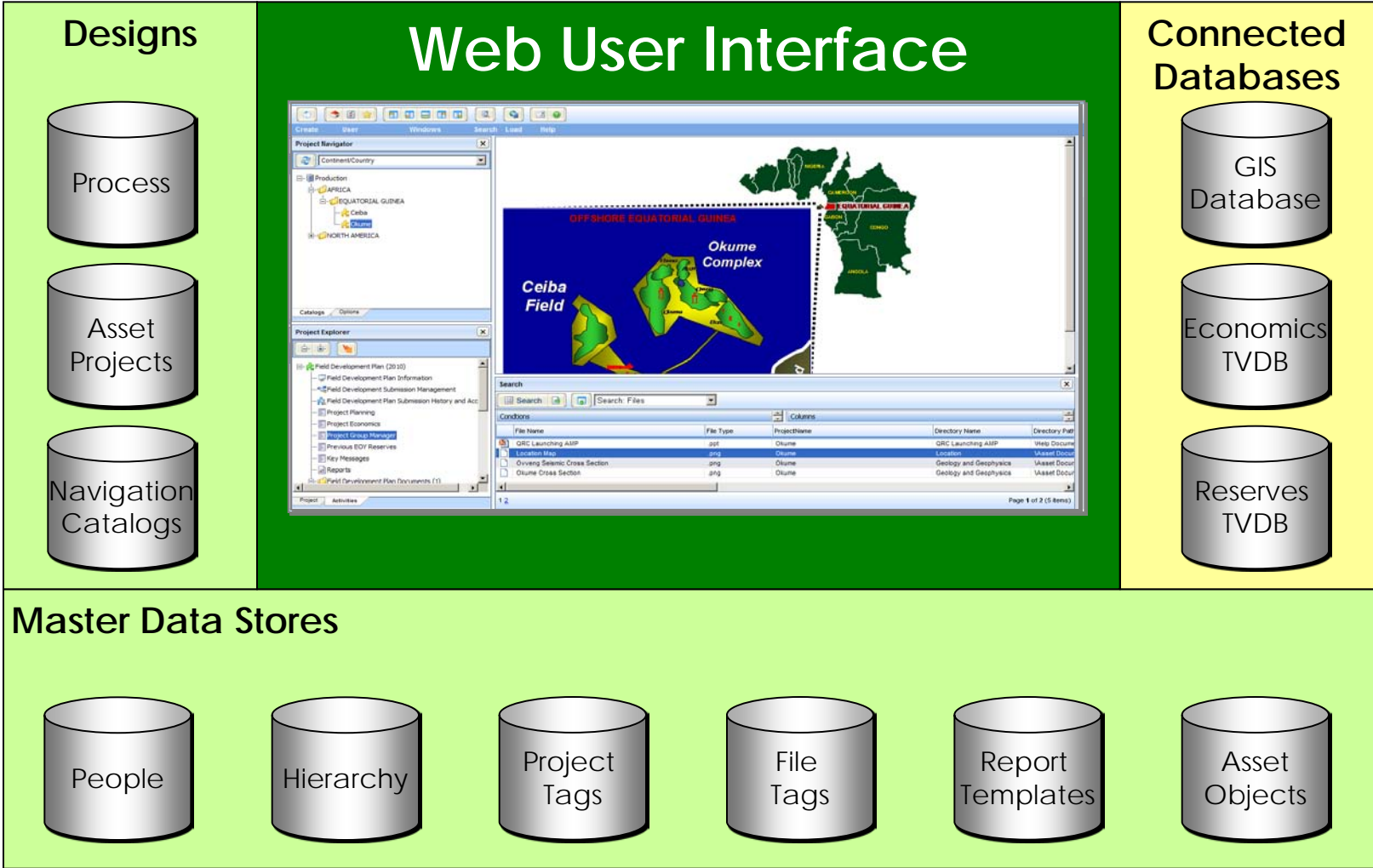
High Level Asset Team Workflow

1 Describe Asset	→	2 Create and Describe Project	→	3 Import or Create Economics Case
4 Create Groups and associate Cases	→	5 Review previous year reserves	→	6 Create Executive Summary
7 Create Key Messages	→	8 Upload and Tag Files	→	9 PUBLISH

Example Supported QC Workflow

1 Find Asset on Map	→	
2 Search Map for Asset	→	→
3 Run Query and Search	→	→
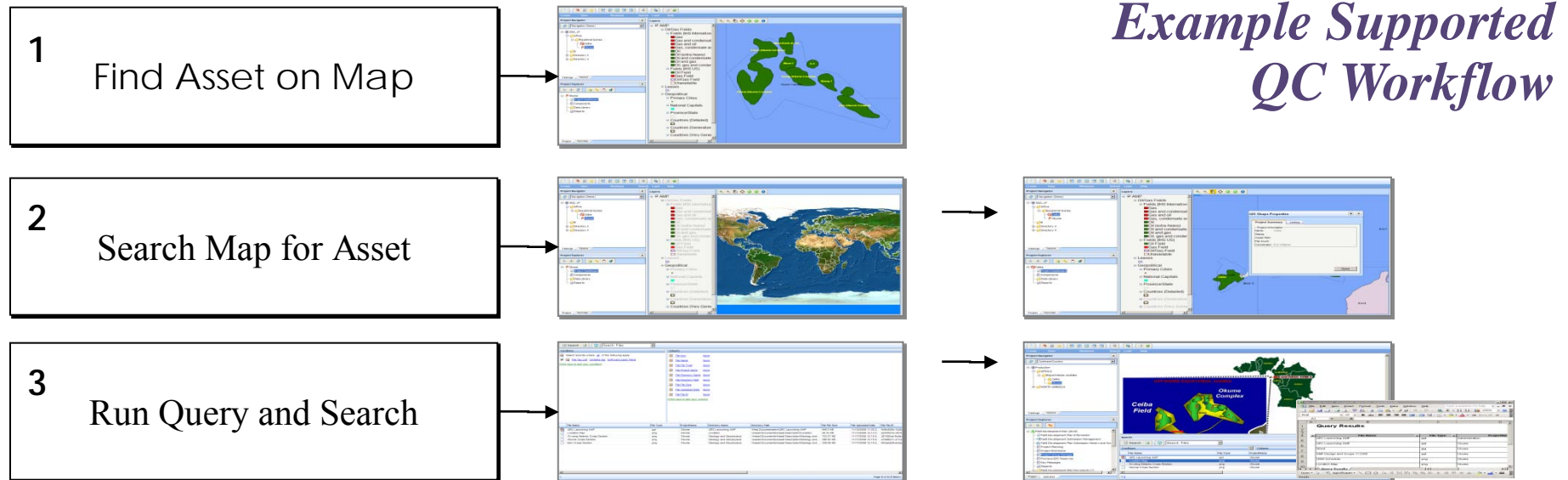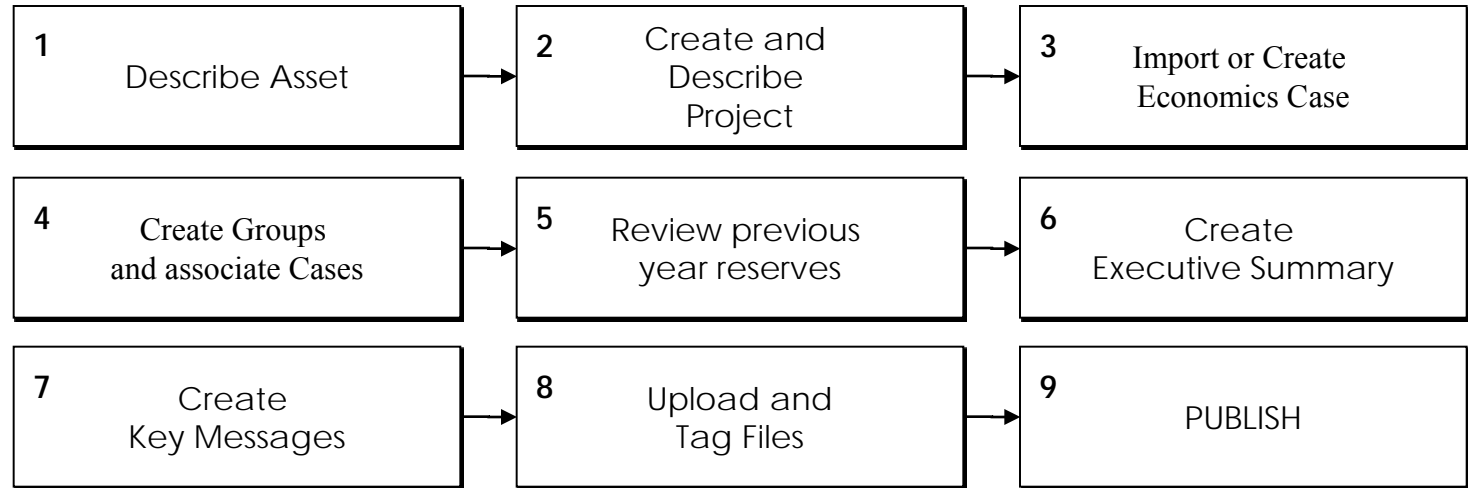
Links to Geophysical Data Locations

Case Study: Seismic Data View

The Prize: Automated Decision Support
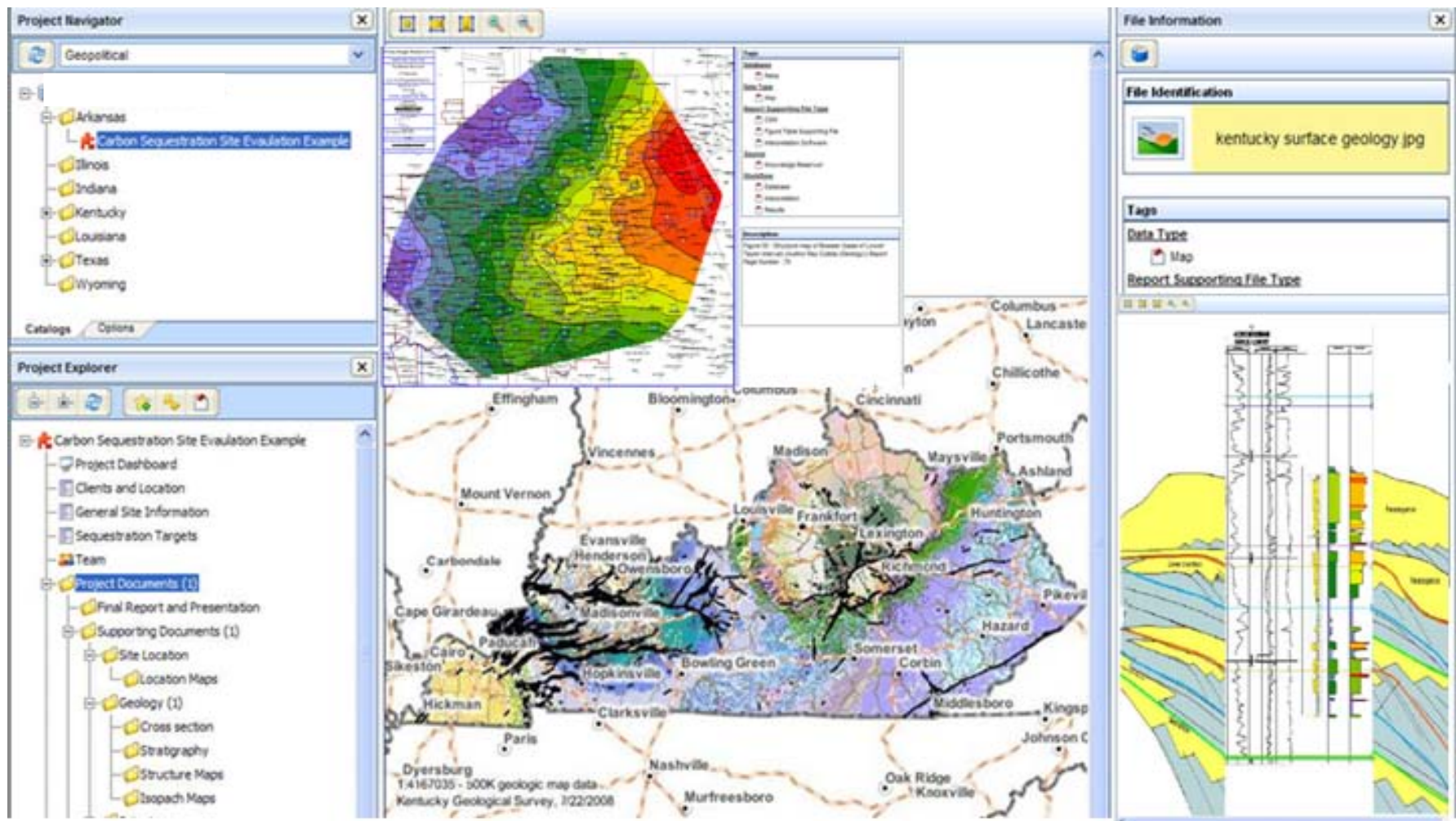
Why use the PPDM model for CO2 Sequestration?

- The data model can be complemented by proven process and document management solutions and a role-based user interface
- Efficient and configurable access to:
  - Project data
  - Documents
  - Images
  - Knowledge repositories
  - Narratives
  - Personnel meta-data
  - Corporate process audit trails
  - Taxonomies
- Repeatable and adaptable model
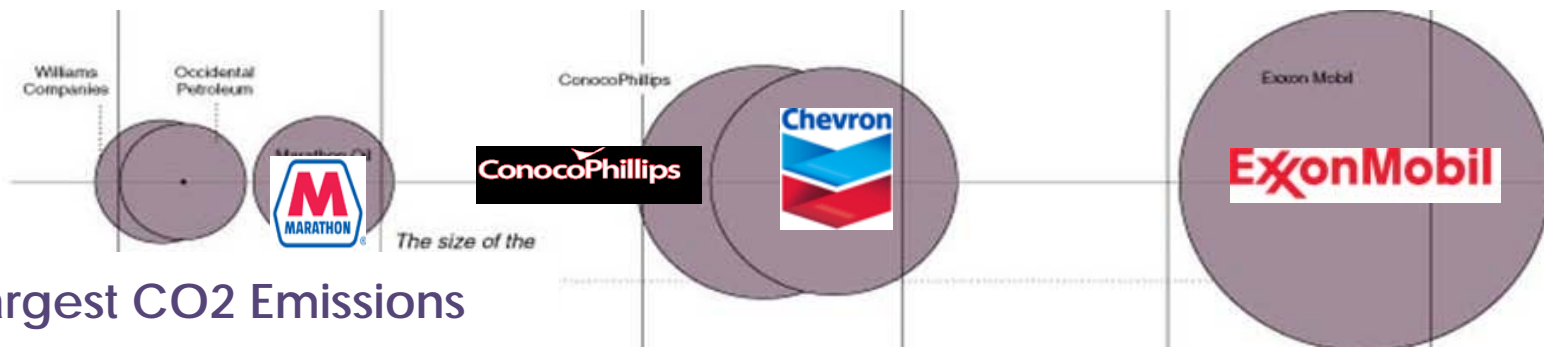- Execution at a fraction of expense allocated for in-house development

Industry Synergy

Oil Company Participants in Department of Energy Carbon Capture Project

Some Oil Industry Members of PPDM

Early Adopters of the PPDM Intelligent Information Management Technology

Largest CO2 Emissions