

# Experience from IM Assessments:

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**E&P Data Management in 2006**

This document summarises experiences with recent assessments to present a picture of the current state of Information Management (IM) for Exploration and Production (E&P) Companies. The most beneficial Information Management Assessments bring together an understanding of the business benefits that arise from good management of Exploration and Production data with a detailed appreciation of the complexities of delivering real solutions. Schlumberger has been performing such “Site Assessments” for E&P companies since the early 1990s.

E&P organisations are becoming much more aware of the need to combine business process considerations with an understanding of Information Management. For some time the most progressive companies have been using IM Assessments as one of the tools to help clarify their IM strategies. Decisions about IM are being taken within the framework of a business cost/ benefit based analysis, rather than viewing data management as a cost that must be continually squeezed.

The wide assortment of IM approaches that provide reasonable results means that conclusions drawn in this document focus on trends rather than being valid for all E&P Companies.

For most organisations significant benefits have already been proven from projects to optimise core domains (especially log curve data and, to a lesser extent seismic and well header information). This has improved confidence that future projects will continue to generate measurable value. The main areas of concern are the domains that are not “fully connected” into the mainstream of E&P process and where tools are less mature. The most crucial of these is the handling of production and drilling data.

Of secondary importance to the concerns with particular domains is the effort to clarify the processes, roles and responsibilities involved in Information Management. Many companies have defined procedures, however these are detached from the real details of implementation, and are hence often being ignored in practice. This is not primarily a technology issue but one focused on change management and business process clarification, the current set of data management tools and applications would be sufficient for the task if only they were being used more effectively.

The document is divided into the following sections:

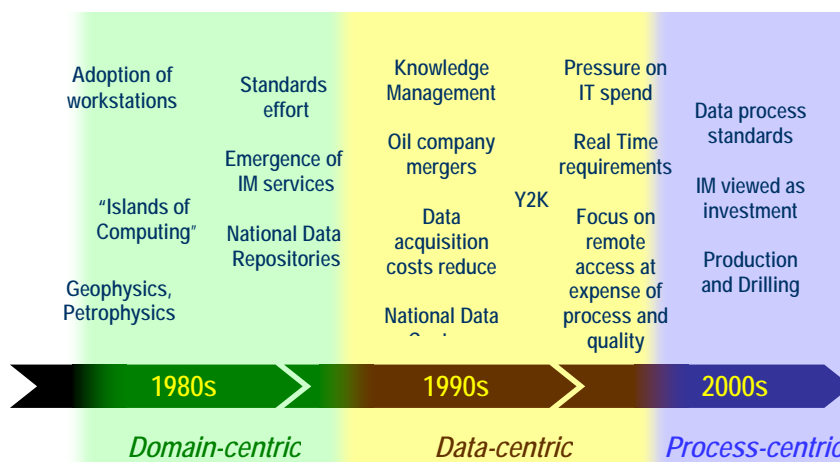
**IM Assessments:** A description of the approach used to conduct assessments and the results that typically are produced

**Results:** A summary of the themes that emerge from analysing recent assessments

**Information Management Landscape:** A brief introduction to one of the key concepts behind the assessments

## IM Assessments

It has been apparent for some time that E&P companies are shifting the way that they consider information management.



During the 1980s the main challenge was exploiting computing power to enable specific tasks. This started with numerically intense domains, such as geophysics and petrophysics and, by the early 1990s had spread to more interpretative specializations such as geology. The key question during this period was “what can we do with computers?”.

By the early 1990s the isolation of these “islands” of computing was impeding progress, this led to a focus on “integration”<sup>1</sup> and resulting standards efforts such as Geoshare, POSC and PPDM. This data centric view built upon the collection of domain specific applications that had been widely adopted by this time. During this phase the key question was “how can we best connect to our data?”.

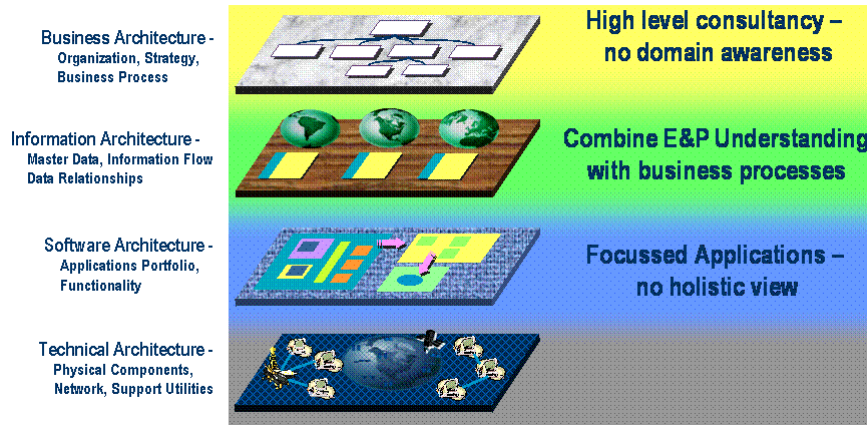
In the last few years a number of E&P companies have moved away from a purely technical focus to a more holistic approach incorporating the business processes that need to be enabled. The spectrum of available integration choices has been recognised, the focus is on understanding the context within which solutions are being implemented. There has always been those that took a business centred approach but until the main “data” questions were clarified their strategies were disconnected from the realities of implementation. Now that the challenges of integration are understood the business processes can be tied in to working solutions. The key question driving this analysis is “why do we want to integrate?”.

To successfully deliver solutions it is necessary to combine business workflow concerns with an understanding of the details of implementation<sup>2</sup>. E&P information covers a wide range of domains each with its own peculiar concerns,

<sup>1</sup> The word “integration” has been widely interpreted, a review of the spectrum of integration approaches can be found in “Information Integration” Petroleum Data Integration, E-Commerce, and Data Management, Houston, Texas April 15-16, 2002

<sup>2</sup> For example see “Data Integration for Disparate Repositories” PNEC7 May 2003

tools and complexities. There are many examples of projects that have floundered because implementers started from a high level and underestimated the importance of details in the existing workflows. The other misjudgement is to focus on “point solutions” each of which provides value but fails to unlock the potential stepwise improvement that could be achieved by taking a wider view.



A good IM Assessment uses a mix of skills to combine the “business process” and “change management” approaches that a consultant would bring with an awareness of the real underlying constraints. Such IM Assessments have a high value for clients:

- Extensive independent appraisal of the company’s Information Architecture
- Combines a wide ranging experience with local knowledge
- Checks the health of Information Management
- Delivers a benchmark for future comparison

## IM Assessment Methodology

Since the early 1990s Schlumberger has been engaged in assessing the way that E&P companies perform information management. Some of these assessments defined the tactical implementation of particular solutions, the more effective ones have taken a strategic view and recommended improvements that were not tied to particular products and services.

The methodology employed during IM Assessments has been refined over the years and is a technique in Schlumberger’s standard project management approach<sup>3</sup>.

As with any business decision investment in Information Management can only be justified by an analysis of the costs and calibration of the benefits. The difficulty in quantifying benefits has often led to a relaxing of the normally

<sup>3</sup> Schlumberger Information Solutions follows a project delivery methodology (PDMP) which is an extension of Prince2 with additional PMI based elements

stringent requirements for measuring them. The clarification of key impacts and validation of monetary values for them is an important element of an IM Assessment.

As an example of the types of impact statements that a typical assessment would produce here are three impacts that affected a single company:

25% of data room time wasted while doing additional searching for data

**Impact:** Annual loss of \$5M \* 25% => \$1.25M

Missing well test data in North Field → wells remain shut in

**Impact:** 250bbbls x 10 wells x 2 months production => \$6.0M

4 out of 5 Field Rework projects delayed for 3 months each while searching for data

**Impact:** 1500bbbls x 4projects x 45days x \$40 => \$10.8M

In order to validate the estimated benefits an IM Assessment must document the way Information Management works today and, normally, recommending a vision of how it should work. This requires an understanding of the workflows, domains and exceptions and how these fit into the organisation.

Documenting the way Information is managed within an organisation requires an understanding of:

**Streams:** how data is organised

**Workflows:** what needs doing when and by whom

**Data flow:** how information moves

**Roles:** which categories of information are held where

**Exceptions:** how IM varies within the organisation

**Organisation:** relationships between groups

These elements together form the “Information Management Landscape” which is described more fully in the appendix.

## Combined Results

During the early part of 2006 a consolidated view of E&P was generated by combining results from recent assessments with some additional sources of information. Most of the source material comes from companies that have had Schlumberger perform an IM Assessment for them, however the supplementary information would seem to indicate that this self selected group is consistent with the wider trends in the industry.

The review was focused on the following four aspects:

**Impact:** Measuring the benefits of Information Management

**Maturity:** The relative maturity of different elements of the IM Landscape

**Landscape:** Which data repositories are used to hold each category of data

### Impact

During the late 1990s and early 2000s a consistent theme was the effort to drive down the cost of Information Management. In some cases this impetuous was pursued without even having a clear definition of the services that IM delivered. This drive to reduce centralised costs has often led to increases in total company expenditure as front line groups have been forced to supplement the centrally funded services to achieve the solutions they require.

The more effective E&P companies have treated IM expenditure as an investment and tied it to measurable benefits<sup>4</sup>. A previous section showed some examples of the impacts that IM has been shown to have in one particular company. The impact statements from the range of companies examined during this review have been based on the different sets of metrics that each company considered critical indicators of value. The diverse range of profiles of the organisations involved means that any general statement of benefits would be of limited value. However there is a common underlying approach that has normally taken to understand value and the types of questions to ask are quite clear.

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<sup>4</sup> See “Digital Data Management Needs a Holistic Approach To Obtain Quantifiable Results” in American Oil and Gas Reporter, Nov 2005

As with all business cases measurements of benefit must start from the costs associated with continuing the current situation and characterise the impact that would arise from completion of a defined project. The main benefits that have been seen as important by E&P companies have emerged have been:

- Improving the productive time of scarce specialists
- The costs of replacement of lost data
- Reducing levels of uncertainty on initial and reworked interpretations
- Allowing the auditing of data flows to provide documented justifications for decisions

With an aging population of scarce specialists it is important to maximise the time they spend achieving the organisation's goals, such as maximising production and maintaining reserves replacement levels. Even given the improvements of recent years it is still the case that data users spend significant proportions of their time locating, validating and archiving data. Using metrics to estimate the value of productive time show that this has been a major benefit of effective IM<sup>5</sup>.

E&P companies have measured the typical rates at which crucial data becomes unavailable. This occurs from a wide range of reasons, through too casual an attitude to tracking and sharing, failure to adequately justify modifications and even a lack of effective backups. Where this has been measured it has turned out to be at much higher rates<sup>6</sup> than any data management groups estimated.

The reduction in uncertainty that comes from better documented data quality and improved data tracking has led to substantial business benefits<sup>7</sup>.

Recent issues with reserves reappraisals have highlighted the need to be able to justify decisions based on the data that was available at the time. Because of changing regulatory environments some E&P companies consider this a new prerequisite of doing business.

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<sup>5</sup> For example see "Managing Drilling Knowledge for Improved Efficiency and Reduced Operational Risk" SPE/IADC Paper 67821, 2001

<sup>6</sup> One company's study in 2000 estimated industry data loss at between 1.5% and 5% per annum. A medium sized E&P organisation could easily have invested \$5,000M in obtaining the data so even a small reduction in data degradation had a significant monetary impact.

<sup>7</sup> The article "Integrated Data Management improves return on investment" from the July 2000 issue of Oil & Gas Journal illustrated the significant effects that reduced uncertainty can have on time to first oil

## Maturity

Another important aspect of Information Management assessments is to examine how mature the handling of information is. A summary of maturity has been an essential element of assessments for more than a decade, recently the concept of maturity has been extended to analyse the different categories of data. The facets selected for analysis are normally these:

**Tools:** gives a measure of the maturity and suitability for purpose of the various applications and systems used to manage data

**Data:** examines the existing set of data, its quality and completeness, this measures, for example how much effort would be required to clean up legacy data

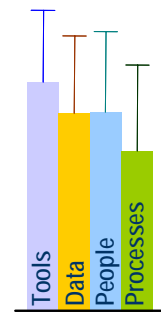
**People:** gives a measure of the abilities possessed by the staff involved in handling particular groups of data

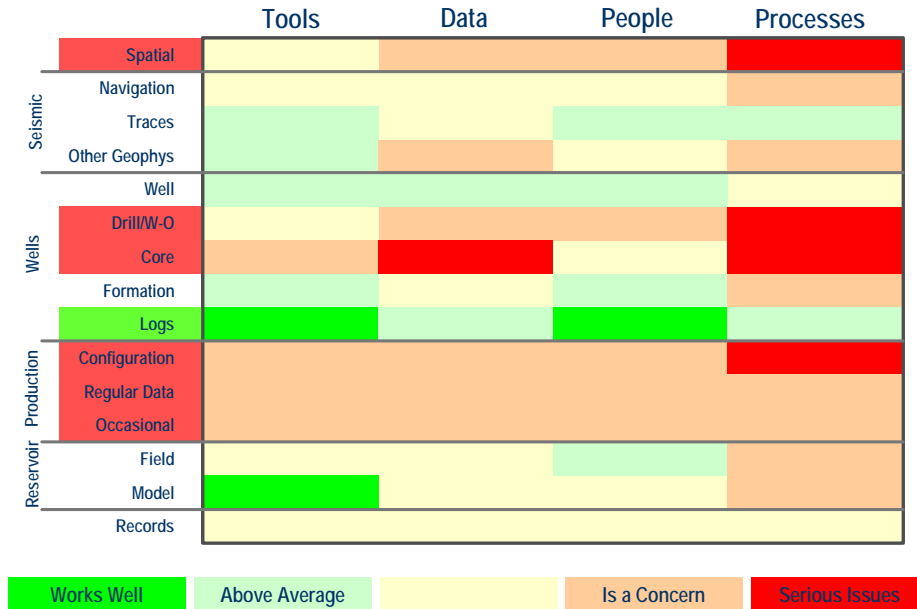
**Process:** is a measure of both how well processes are defined and, more importantly, how well they are followed

When considering a range of E&P companies the most important differences in maturity are mainly related to the different categories of data. The difference between one category of data and another were consistently far larger than the differences between, say Tools and Processes within the same domain.

Having said that there was a consistent and significant difference between the facets. The current set of Tools were consistently rated highly, the differences between People and Data were not significant and Processes were a consistent concern.

Anecdotally there were a number of assessments which highlighted comments from different companies to the effect that processes were generally well defined but not being followed.



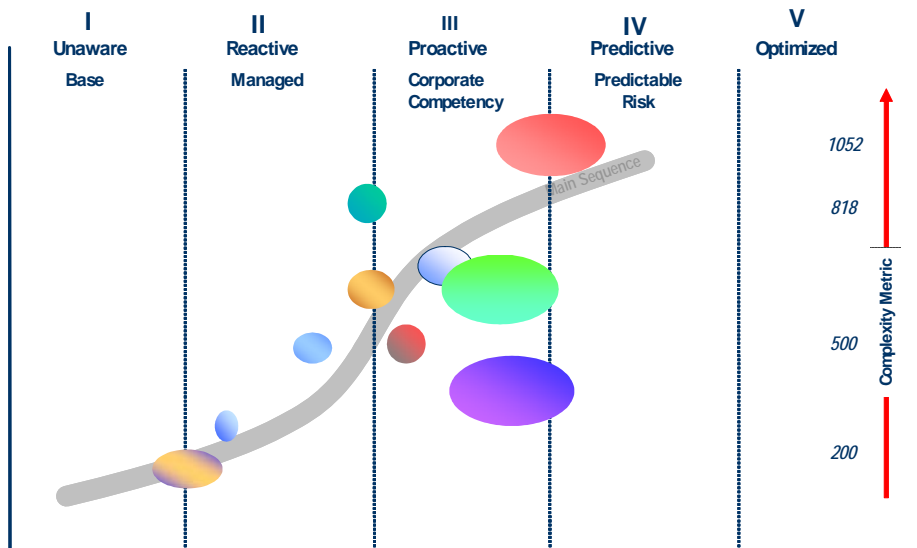


The table above presents the consolidated analysis from all the reviewed organisations. The key features are:

Throughout the companies the handling of log curve data was consistently good. At this time the majority of E&P companies employ a high quality of processes that are effective for managing curve data

The Spatial, Drilling, Core and especially Production are a cause for concern in many companies. Their management is not well documented or linked closely into the other elements of the organisation. Most companies feel that there are opportunities to increase the value that can be obtained from information in these areas

The definition and especially implementation of documented processes needs improvement

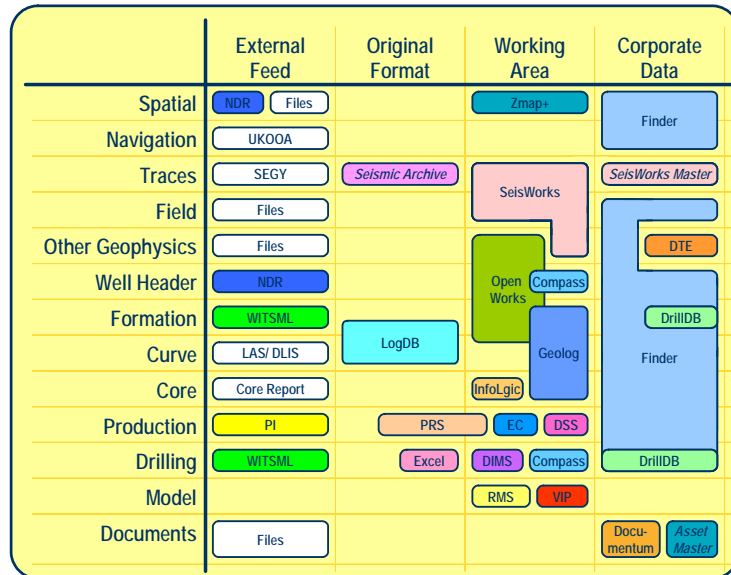




A summary is presented in the diagram above, this combines the extended Data Management Capability Maturity Model<sup>8</sup> (DMCMM) with a measure of IM complexity that is calculated from the IM Landscape. Each oval represents a different E&P company, the size indicating the size of the organisation. From this diagram it can be seen that most E&P companies are clustered around a “main sequence” that illustrates how more mature IM environments enable higher levels of business process complexity. In addition it can be seen that the larger companies tend to be more mature, this arises because of the greater leverage that they gain from investments in improving processes.

### Landscape

In the appendix the concept of the IM Landscape is explored. Some example of the usage from a single E&P company are provided as part of that discussion.



Here is another example. Even with this high level overview it can be seen that the image above shows a clear mapping between roles and repositories.

When a detailed analysis of all the available landscapes was done it quickly became apparent that from this viewpoint every E&P company is unique. There are sufficient choices available, and a small enough group of E&P companies that there are no data domains which can be said to have a “typical” implementation.

<sup>8</sup> See “Maturity Models for E&P Information Management” ADIPEC 2004 (SPE 88666)

		Example Repositories	Comments	Issues
Seismic	Spatial	ArcGIS, AutoCAD	Copying shapefiles	Geodesy
	Navigation			Link to (and from) maps
	Traces Other Geophys	SeisWorks, IESX, ProMax, Omega	Well defined processes but no management of "approved" seismic	4D Where Justified What extra data is important?
Wells	Well	Finder, Proprietary	Clear and shared processes	Well Path coordinates
	Drill/W-O	DIMS, Compass, DrillDB	Disconnected outside drilling	Linking to rest of E&P
	Core	Documents, Finder	Informal use (flexible)	What Value?
	Formation	Finder, GeoFrame, OpenWorks	Clear process, lack of audit	Stratigraphic schemes
	Logs	Recall, Geolog, Finder	Clear process and connections	
Reservoir Production	Configuration			
	Regular Data	Excel, PIMS, OFM, Energy Components, Prosper	Lack of formal process, disconnected outside production	Unlocking value in existing data (Integration and clarity)
	Occasional			
Reservoir	Field			
	Model	Petrel, RMS, Eclipse	Good but informal process, no designated approved models	Audit trail and safeguarded results
	Records	Documentum, Custom DMS	Lots of experience in implementation Lack of "success"	User Frustration

The figure above selects the main themes that can be discerned from examining a range of E&P companies.

## Appendix - Information Management Landscape

Estimates of the business impacts of IM are valueless if they are not based on a realistic understanding of the way that E&P data is handled. The business processes involved in Exploration and Production cover such a wide range of different disciplines, the requirements are so diverse, and the influences that small details can have over the result are potentially so significant, that for a description of the information “environment”<sup>9</sup> to be valuable it must take into account:

**Streams:** how information handling is clustered by category

**Workflows:** what needs doing when and by whom

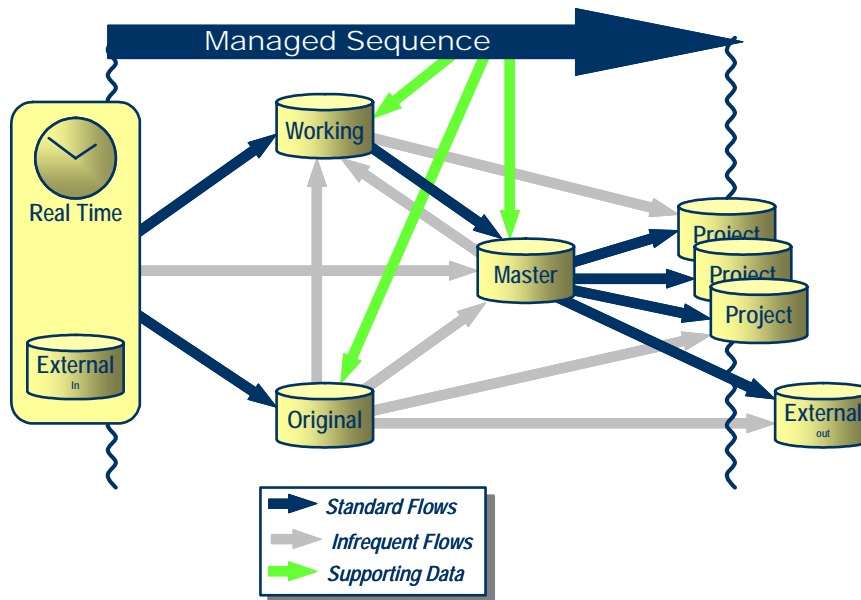
**Data flow:** how information moves

**Roles:** which categories of information are held where

**Exceptions:** how IM varies within the organisation

**Organisation:** relationships between groups manipulating information

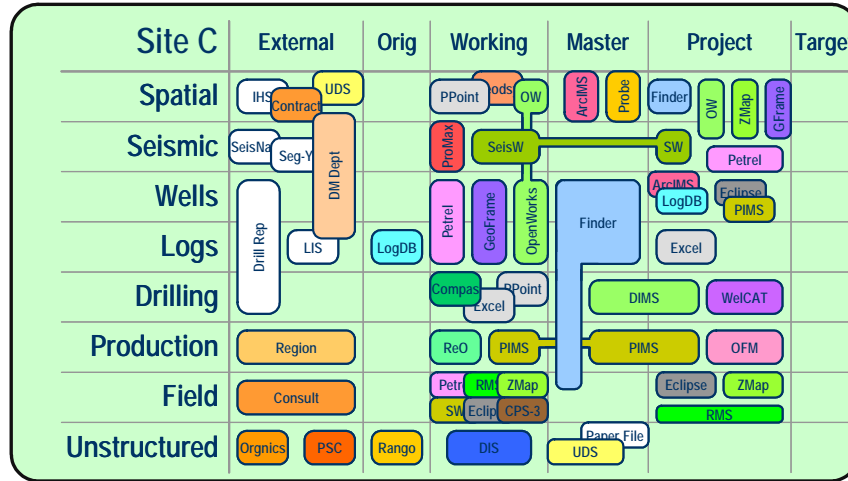
To sufficiently understand a particular organisation’s Information Management practices information about these attributes must be gathered from a variety of sources and shown in a consistent way.



Over the course of many IM assessments the above selection of “roles” has emerged as a reasonable encapsulation of the way different streams are handled in most companies. Most data streams in customers are managed with a subset of these roles.

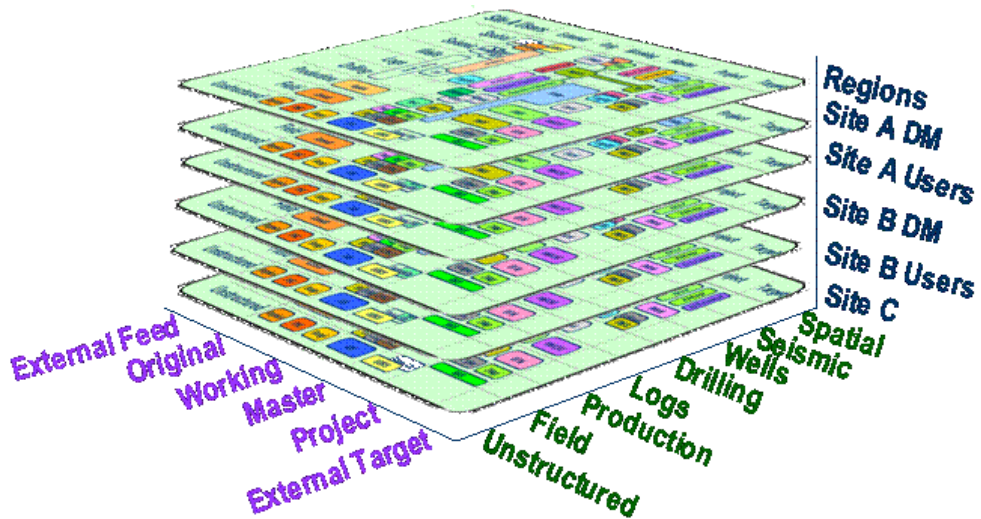
<sup>9</sup> The business benefits of understanding information flows has been discussed many times, for example see “Deliver Your Master Data Store” SMI-2003

Documenting the landscape typically starts by describing which repositories are used to implement these roles within the company. For each stream the “repositories” that play particular roles are defined. For example where does external data come from? Where are original copies held? Where is data being edited? Where is the “official” data held (the corporate database)? Where is data used? And which external groups require copies?

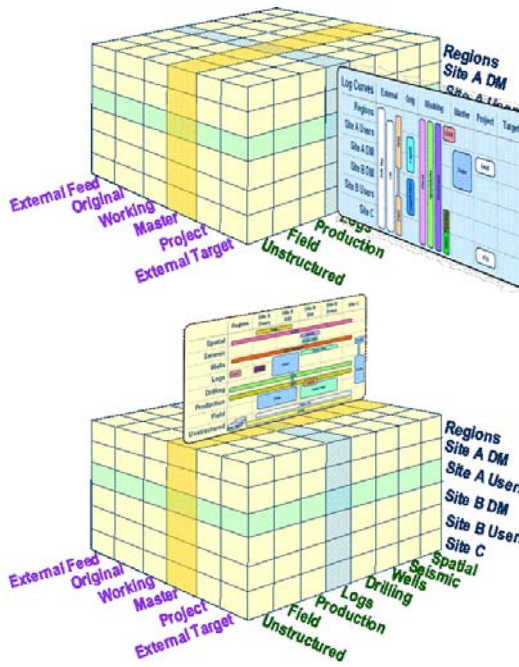


In the figure above the E&P data has been consolidated into 8 streams. Here we can see the way that this group manages all their data. Notice that while some roles are very clear, in the example above for example, master well data is held in Finder, others, such as the working data for Field information have more options. For some cells these overlaps come from the fact that we have consolidated different fine grained categories of data into a single cell, for others there is an underlying ambiguity in the way that the group works.

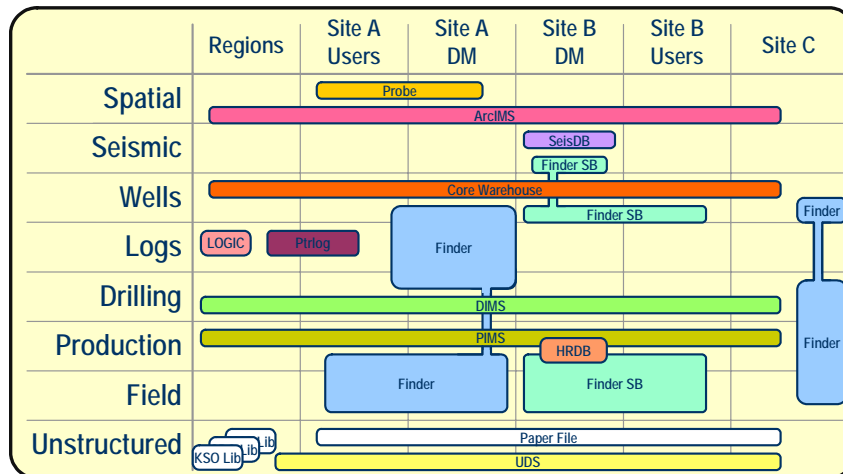
In fact this is not, of course, a picture of the way a whole company operates, rather it is the way that a particular group within the company works.



Any real E&P company has a number of distinct locations that vary the way data is manipulated. Each different approach generates a distinct map, stacking these different sites generates a volume of streams, roles and locations.



Information from this volume can be extracted along one vertical direction, for example to examine all the repositories that handle log curve data throughout the organization, or in another direction to show how “Master Data” handling varies from between sites.



In the above figure we can examine where this customer stores approved data, and how that varies from one location to another. These views allow the user to explore the roles that different repositories play.



The figure above shows a typical set of workflow stages that a company could define for any stream. The default relationship between the roles and workflow stages has been defined based upon experience from numerous assessments. Analysis shows that most E&P companies follow a similar set of workflows and, while some adjustment is often required this tends to be quite limited.

Adding in the data flows and group responsibilities provides a complete picture of information management that is invaluable for documenting current activities and exploring the vision of how they can be improved.

Reasonably sized E&P organization normally use between 50 and 100 distinct repositories of data (databases, on-line files, applications, paper files and so on). They manage more than 50 different categories of information and work in up to a dozen different locations. Sharing all this information in a way that makes it easy to use is a challenging task.