Mark A. Priest, Fahad Ali, Mohsen Baghazal, RasGas Company Limited

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Abstract:
The transition from development to sustainable production is well underway within RasGas Company Limited's (RasGas) Subsurface Group. The stage is set for many decades of production and in order to ensure information and knowledge is properly captured and protected, RasGas Subsurface Group established a set of information and knowledge management processes in a project called The Data Management Acceleration Project (DMX). The goal of DMX is to ensure the right information can be delivered to the right people at the right time, in the right format, and with known data quality. This paper details the DMX project, how this project differs from data management projects of the past, benefits the DMX project has yielded to date, and the future of Subsurface information and knowledge management in RasGas. The key differences between the DMX project and data management projects of the past are the project deliverables and the level of involvement from the customer (data owner) community. The deliverables of the DMX project are a collection of sustainable processes by which data are acquired, quality checked, validated, stored, protected, and accessed. The level of involvement from the customer community was critical to the success of the project. The continuing commitment of the customer community in the form of data and process ownership are key to the sustainability of the processes in addition to ensuring the ongoing benefits of the information and knowledge management programme.

RasGas Company Limited:
RasGas Company Limited (RasGas) is the operator of all RasGas projects and is owned by Qatar Petroleum and an affiliate of ExxonMobil.

Based in Ras Laffan, Qatar, RasGas currently has seven LNG trains in operation with a production capacity of around 37 million tonnes of LNG per annum.

RasGas played a significant role in realising the vision of His Highness the Emir of the State of Qatar, Hamad Bin Khalifa Al Thani, for Qatar to become the worlds largest of exporter of LNG with a production capacity of 77 million tonnes of LNG per annum.

RasGas wells produce natural gas from the North Field, the largest non-associated gas field in the world with proven reserves of more than 900 trillion cubic feet of natural gas.

Shift in focus from development to production:
RasGas Subsurface development activities began in 1998 and were completed in 2009. As RasGas prepared for the transition from development to operations, management recognised the need for

subsurface data management to widen its scope to include both development and operations data and to tune into the operational needs of Surveillance Engineering. The vision: build a sustainable process of information and knowledge management that will ensure the data assets acquired and generated during the field development phase and the data, information, and knowledge acquired during operations and surveillance is organised and managed in such a way as to ensure future generations of surveillance and operations engineers have all the information required to manage the reservoir and ensure production remains on target. The solution must fulfil the current information needs in addition to being flexible enough to meet future information and knowledge management requirements.

The DMX project

The Data Management Acceleration project (DMX) was commissioned to realise the integrated data vision of RasGas Subsurface management. The project scope and approach were intentionally different from all previous projects in that the deliverables of the project were a set of processes that describe the best practices of data management, data ownership and data access for the company. The data management process and the sustainability of the process for the 35 most important subsurface data types was the central focus of the project. More than 70 data owners, subject matter and process experts, workflow consultants, data clerks and support staff contributed to the success of the DMX project.

The DMX difference

Unlike many previous projects which focused on software installation and data loading, the DMX project focused on the process of data capture/creation, data governance, data validation, and data integration. It covered the full life cycle of each data type and the best practice workflows that ensure data is captured, stored, protected, and accessed in standard ways. Another key difference was the role of the data owner. Each data type in the project scope had a defined owner department/section responsible for acquisition/creation in addition to having responsibility of ensuring the scientific validity of the data. Yet another difference between the DMX project and previous projects was the time commitment of the subsurface engineers and geoscientists. The involvement of the data owners in the DMX process was critically important in order to capture the current and desired future processes, but at the same time, the DMX project had to be sensitive to the level of sustained commitment by the data owners because while the DMX project was under way, the business was focused on a 10 rig development campaign. Finally, in order to minimise the potential time conflict between DMX project work and normal business activities, it was decided to proceed with a time and materials based project rather than a fixed price, lump sum model. The data owners greatly appreciated this methodology and comparatively open project time frame. As a result, the data owners contributed high quality time to the project, at the right time, and not in competition with operational focus.

The DMX project strategy and assumptions

Project strategy:

- Use as little time as possible from the business, but enough for a successful project outcome
- Define the master process
- Focus first on the fundamental (Tier 1) data types: XYZ, Header, Directional Survey, Markers, Perforations
- Demonstrate value at the completion of Tier 1 data types or stop the project
- Generate project momentum as early as possible
- Sustain value and project momentum
- Keep the solution as simple as possible in ensure sustainability
- Establish a method of data challenge in order to engage all users in the QC process
- Leverage the expertise of the data owner (experts) to a wide audience
- Ensure data are presented in an easy to use way and intuitive formats

Project Assumptions:

- Each data type has one and only one owner department or section within the organization
- The data owner is responsible for the scientific correctness of the data and for carefully tracking the quality provenance of the data from the raw/capture state through to finalization
- Data quality will improve as data are made easily visible to the organization
- A data, information, knowledge management culture will be created in recognition of the value the project brings to the business

The DMX process and data scope

The first focus area of the project was the creation of a master process that would result in the definition of data governance for the data types in scope of the project. It was assumed that the project team would become more adept at applying the process to subsequent data types. The project team did translate lessons learned from the early data types and significantly shorted the amount of time required for the later types. In order to maximise the available consulting resources, and at the same time, remain sensitive to the time required from the data owners, the data types were worked in parallel through the phases of the DMX process.

Careful consideration was given to the definition of the Tier 1 data types. It was determined that XYZ, well header, directional survey, markers, and perforations would make up the Tier 1 data scope. These data types were (and continue to be) widely shared between multiple applications within the subsurface technical environment and it was considered essential to ensure consistency between all data sources and that each copy remains consistent with the prime data source. Another consideration was that these data types are the fundamental building blocks of a well managed subsurface data federation and represent the framework in which all other well data types exist.

The DMX Data Scope

Tier 1 Data Types
XYZ
Directional Survey
Well Header
Markers/Tops
Perforation
Well Status

Tier 1 data types represent the framework into which all other data will be placed.

Tier 2 data types focused on Operations and Surveillance

Tier 3 data types focused on drilling and Completion data types

Tier 2 Data Types
QTA Log
Produced Volume
Allocated Volume
WBA
Well Test-PVT
Well Test-PLT
Well Test-DST
Well Test-MDT/RFT
Well Test-Other
Production Test
Sample Test (RG Lab)
Production Events
Reservoir quality
LogDM-OH
LogDM-CH
LogDM-Mudlog
MRT/SRT
Log Catalog

Tier 3 Data Types
Core
Culture
Checkshots/VSP
Wellbore Integrity
Wellbore Schematic
Workover Plan
Completion
Drilling Program
Completion Program
P&A Plan
Daily Operation
Mud Rhelogy
Drill String
Casing Tally
Cementing
Stimulation

At project start up, the technical applications and databases were largely in place, and to a certain extent, populated with operational data. However, two pillars of the managed data environment were upgraded during this project: the legacy Drilling and Completions and Petrophysics databases were replaced with commercial solutions. Many well data types such as well location, directional survey, markers/tops, and perforations were by necessity duplicated across several different project databases and had no method of ensuring consistency or currency of the data between sources. One of the goals of the project was to "tie" data across all subsurface systems and to identify master sources of information, owned and operated by the data owners and all copies of the information. Any data differences between the master source and the copies were brought to the attention of the data owner and the owner of the project database containing the incorrect representation of the master data.

The DMX process phases

The DMX master process was arranged into 6 phases: Discovery, Analysis, Design, Build-Test-Document, Install-Test, Close-out. Each data type was processed through the 6 phases with 5 to 6 data types working through the process at any one time in order to maximise the workflow consultant's time in addition to being as sensitive as possible to the time required from the business.

The Discovery phase represented the kickoff point for the data type. During this phase, the data owner was established/committed and any existing data handling processes were identified along with any existing QC process, data storage and access methods were investigated.

The Analysis phase captured the "As-is" processes of data acquisition, QC and validation, storage and access methods. Data owner signoff ensured that the "As-is" picture was accurate and complete.

During the Design phase, the "To-be" workflows were defined by the data owners, any changes/enhancements to the data storage methods and schema were identified and all "codes" compliance issues were identified. Data validation rules were gathered from the data owners and transfer and synchronizations needs were identified then specifications for data transfer and synchronization with Shareholders and internal recipients were drawn up. Also captured in this phase were the report and data visualization specifications for the data type.

The Build/Test/Document phase was concerned with creating the programmes and scripts required to load, manipulate and perform a first-pass level of QC and validation on the data. Scripts to enable data transfer to Shareholders, and data synchronisation between master and project data were built during this phase along with data inconsistency reports to ensure differences were known to both the master data owner and the user of the data which was incorrectly represented in a project database. Finally, the end-users reports were built during this phase. The data owner set the baseline specification of the data visualisation requirements then the data users, i.e. the customers of the data owner, were consulted to insure the visualisation specification was sufficient for the needs.

During the Process Installation and Testing phase, the processes associated with the data type were installed into the production database environment and re-tested. Additionally all process documents are completed.

The Close-out phase marks the end step of the DMX process. The data owners review all processes and sign off, lessons learned are captured and the data owner rolls out the data type and processes to the organisation.

The DMX Deliverables

The DMX project deliverables were the sustainable processes that were created under the direction of the data owners. The workflows describing data owner, data access and data management responsibilities were captured in data ownership, data access and data management process manuals. The best practices which were documented in the process manuals were installed into the organization under the direction of the data owners. All DMX processes are planned for formal and critical review every 36 months or as needed in order to reinforce the best practices or adapt the process to account for changes in workflows, software, or new best practices.

The Data Owner process document contains a description of the Owner's responsibility regarding the acquisition or creation of the data, the QC and validation process, and finally the storage process which details the step-by-step instructions regarding how the data are manipulated and verified within the specific application used as the master source of the data type.

The Data Management process document describes the infrastructure required, the database or application which serves the role of the master source for each data type. Also contained in the Data Management process document is a detailed description of how the data type is integrated within the subsurface managed data environment. In many cases, due to application requirements previously described, data are required to be copied and loaded into more than one target application or database. The description of how these types of data are measured across multiple sources to ensure each of the copies of the data remain consistent to the prime source is also contained in the Data Management process document.

Finally, the most widely distributed process document was the Data Access process. This very brief document describes the single best practice by which the best data or "Best Answer" can be accessed via the subsurface data portal.

Project momentum

Project momentum was generated early in the project by delivering tangible value to the subsurface organisation. As the processes controlling the fundamental data types, XYZ, well header, directional survey, markers, and perforations were perfected by their respective data owners and the data made available to a wide user audience via the subsurface technical data portal, less time was spent by the data owners fulfilling data requests via email or phone. The recognition of the improvement in data quality improved portal usage which in turn emphasized the ease of data access as compared to the legacy system of phone calls and emails. Efficiency gains were multiplied as each successive data type was perfected and brought on-line and the overall improvement in data quality led to a high level of confidence as the data were combined and integrated through out the management data environment. Easy access to high quality data and reports that integrated many types of data in meaningful and familiar ways helped to entrench the new processes in the organization.

Enduring value

The earliest and most significant benefit the project yielded was organisational time savings and efficiency. By establishing an easy to use data portal, each data owner's expertise is leveraged across the entire data user community. Before the project, subsurface professionals spent as much as 65% of their available staff time searching for, reconciling, and preparing data for use in analysis, surveillance and decision support. The secure data access has reduced search time by more than three staff years and has reduced the support load from the data owner's perspective by providing the data user community a single place to look for the best available data.

Another early value was in regard to data quality. By presenting data to a wide audience of consumers via and easy to use web portal as apposed to the limited access provided only to data owners who know how to use the applications used to master the data, meant more eyes on the data. The "Data Challenge" mechanism associated with each data type ensured that data problems or inconsistencies were reported back to the data owners and the issues tracked until closure.

The extended time line of the project allowed for many focused working sessions with the data owners. The frequent yet focused interaction with the data owners combined with the value that was generated when data types were rolled out to the data user community served to establish a culture of data, information and knowledge management and the realisation that everyone pays a role in the pursuit of perfection with regard to information quality.

The sustainable data governance processes, the efficiency gains, and the smoothness and effectiveness of the overall system has prompted the data owners to grow the data user community. Information consumption has grown substantially as a result of easy access to data of known quality.

The Data Access, Data Owners, and Data Management process documentation are useful training materials for newly hired Subsurface Staff. The process documents clearly describe the provenance of data through out the complete data life cycle.

Finally and most significantly, a culture of data/information/knowledge management has firmly taken hold within RasGas as the RasGas Subsurface has begun to realise the benefits of information and knowledge management as a result of the DMX project. By combining the DMX data types in meaningful ways, information is created that supports reporting, operations, and surveillance functions in addition to providing input to technical decision making. Decisions and lessons learned along with time lapse views of changing well and reservoir conditions are saved with relevant context which has become one of the building blocks of knowledge management for the Subsurface group.

Sustainability Outlook

The business is acutely aware of the value of the data resources along with the financial and intellectual investment associated with the data, information, and knowledge value chain. This awareness translates into commitment to the evergreen process of data, information, and knowledge management and the commitment of each of the data owners to maintain a sharp edge of correctness on the data.

With the strong commitment and support of the subsurface management team, the data management organisation is committed to fulfilling its responsibilities as described in the data management processes and for overall stewardship of the subsurface information and knowledge management and delivery system and to delivering new requirements to the business, at the speed of business.

It has long been recognized by the E&P upstream sector that effective subsurface data management organisations must have a deep and wide range of knowledge of systems, applications, data types and formats, in addition to substantial subsurface and production related domain knowledge and experience. The RasGas upstream data management organization has established a progressive and comprehensive training framework that is committed to the ideals, requirements and future with regard to effective stewardship of the data, information, and knowledge resources entrusted to the data management organization.

Finally, another positive indication that the data, information, and knowledge management culture has firmly taken hold in the RasGas Subsurface community is the fact that the solution is being "sold" by the original end-customers to other parts of the business and to the Shareholders.

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