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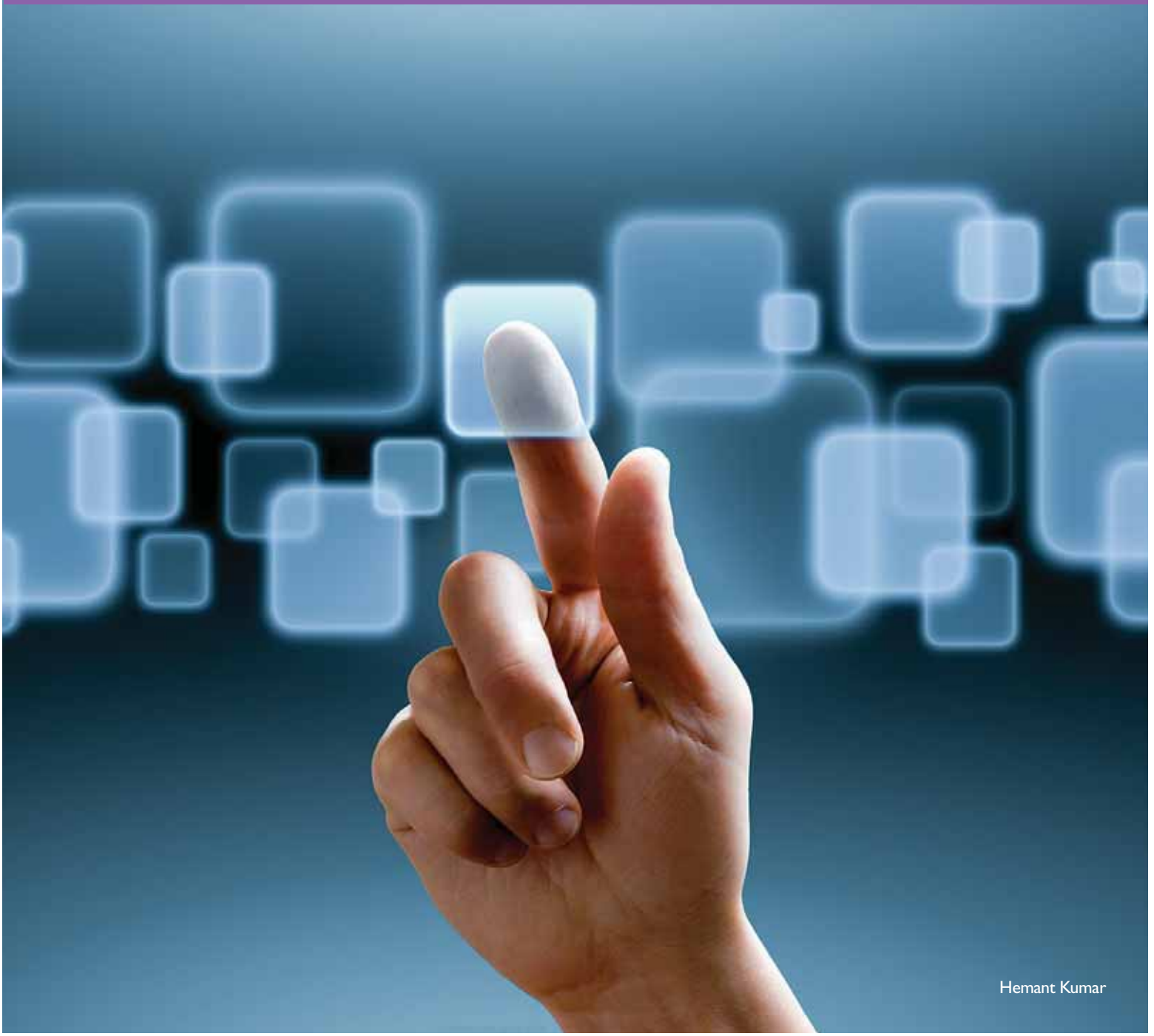
ACHIEVING SUPERIOR OPERATION RELIABILITY IN UPSTREAM INDUSTRY

A case for transformation



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Executive Summary

The E&P industry today faces tough business challenges. There is a constant pressure to maximize production and reduce cost to improve financial performance. At the same time, the industry is dealing with issues of aging assets, skill shortage and a tough regulatory framework, all of which add to the business challenges.

There are operational challenges as well. As assets get older, their performance changes in the form of high GOR, increased water cut, sand production, and increased pressure fluctuations to name a few. Asset equipments come under further strain in addition to the normal operational wear and tear over the years. Under these conditions operation reliability is severely tested as new production failure or deferment modes show up in asset equipments.

In such a business environment, there is a need for high focus on continuous reliability improvement to sustain uptime and ensure high level asset integrity. Given that reliability improvement activities consume significant organization resources and money, it is important to have a well-managed reliability improvement process to deliver value from such activities and minimize wasteful expenditure.

Though E&P organizations have some form of reliability improvement processes, they suffer from some common issues related to information and knowledge management, collaboration and workflow inefficiency. These issues are known to impact efficiency and effectiveness of the reliability improvement process and prevent organizations from realizing the maximum value from their reliability improvement initiatives. Based on our experience with several large business process transformation initiatives across various E&P organizations, we believe these issues can be addressed with a holistic transformation program.

The objective of this paper is to present a case to include reliability improvement process in organizations transformation agenda and increase its efficiency and effectiveness.. We have listed key principles that should be applied to the transformation program to generate maximum value out of it.

An Introduction to Reliability Improvement Process - a Hypothetical Reliability Improvement Scenario

The following hypothetical case illustrates a recurring defect scenario for critical equipment that leads to an equipment reliability improvement program.

In an E&P company, on one of the asset facilities, an injection gas compressor (high pressure centrifugal type) broke down due to failure of compressor Dry Gas Seal. Since there is a regulatory restriction on gas flaring, oil production needs to be constrained in order to keep the gas flaring within limits.

In addition to maintenance cost, there was an immediate deferment of 15000 barrels of oil per day due to lost production. As a short-term measure, asset used a workaround provided by the OEM (Original Equipment Manufacturer) and based on their recommendation decided to operate the compressor below the design capacity which has been causing a daily production deferment of 3000 barrels of oil due to constrained production.

The dry gas seal has failed 5 times in the past 2 years leading to similar financial losses. After the fourth failure, reliability improvement work was conducted six months ago but it wasn't effective and failure reoccurred.

The management is not happy about this situation considering the high cost of failures and damage to the company's reputation. To seek a resolution, a reliability improvement program is initiated. A task force is formed with people from various functions such as operations, maintenance and integrity, engineering and HSE. A brainstorming session is conducted and various actions are decided to analyze the issue in detail. Some of the actions are:

- Check the design of the seal gas system, assess its suitability for the current operations and if it's previous running conditions comply with the OEM's recommendations
- Refer to history of previous failures, study the reports of previous investigations and root cause analysis done by previous teams
- Analyze the process gas composition and examine the past samples recorded
- Check the suction scrubber for any anomalies and any significant observations recorded by technicians in the past
- Check vibration levels of the compressor and compare it with similar compressors on other assets
- Check the routine maintenance task lists of workers and inspection procedures to see if they comply with the best practices
- Examine the past preventive maintenance jobs done on the equipment and see if the recommendations were implemented
- Check the details of past work orders for similar failures to assess corrective action performed and analyse effectiveness of correction.
- Study previous third party audits conducted on the compressor and check if recommendations were implemented.
- Study past start-up details and compare them with reported process gas composition.
- Search for history of previous failures of other components of compressors including root cause analysis and details of corrective actions

The program's key objective is to improve the MTBF to at least 36 months from the current level of less than a year.

To achieve their goals, teams will have to interview different people including shift supervisors, technicians, subject matter experts, OEMs and other asset teams. They also need to analyze various types of information associated with equipment and surrounding systems to identify the root cause and come up with appropriate resolution. Some of the information types the team would have to analyze are listed below.

Performance Data

- Maintenance management data
- Corrosion data
- Engineering drawings
- Real-time data (pressure, temperature, vibration etc), critical events, alarms
- Routine inspection tasks
- Sample data

Equipment Models

- Process models
- Surface network model

Documents and Records

- Operation manuals, equipment manuals, maintenance guidelines
- Trouble shooting reports
- Vendor reports, equipment design limits
- Third party audit data
- Best practices
- Policies, standards and guidelines
- Photos and video footage of equipment

Common Issues with Traditional Reliability Improvement Process

Below, we have described issues that are commonly seen in traditional reliability improvement process in organizations. Also described is the impact these issues would have on reliability improvement initiatives similar to hypothetical case described above.

Common Issue 1: The information, documents and records created during the lifecycle of equipments are collected, stored, processed, and archived in various databases, shared drives or end-users' machines. Information systems have limited integration and make it difficult for users to work with the information the way they want. Documents and records stored on shared drives, individual PCs or in hard copies are difficult to access.

Impact: The staff has to spend a lot of time in searching for the required information and converting it into an analysis-ready format. There are potential conflicts between the information received from different sources creating doubts about their trustworthiness. The result could be inaccurate or incomplete analysis or delay in completing activities.

Common Issue 2: RIP requires a multi-disciplinary team to work together and share information with each other to analyze the issue from different angles. In addition to this, the staff has to engage with external parties comprising OEMs and outside consultants. Typically organizations lack the necessary infrastructure, tools and procedures to effectively collaborate with experts sitting in different locations and integrate them into the reliability improvement activities.

Impact: The staff is not able to effectively communicate, freely share critical information with SMEs or external consultants and monitor the execution of recommended action from a central location. This leads to poor diagnosis and suboptimal resolution of the reliability issue.

Common Issue 3: RIP typically involves the following key activities:
• Identification of reliability improvement opportunity through fault identification or proactive monitoring or performance reviews.

- Risk assessment to screen and prioritize the opportunity.
- Analysis including root cause analysis of the underlying issue and defect identification.
- Action identification to fix the defect.
- Execution of recommended action items.
- Review of post implementation performance and closure of opportunity.

Typically organizations lack a well defined and standardized workflow management mechanism to help the staff manage these activities and generate information therein in an efficient and effective manner.

Impact: The staff faces hand-over delays, lack of visibility into tasks and silos of information creation with different people maintaining their own documents and multiple versions of the same. This leads to administrative overheads such as staff maintaining multiple trackers, tracing information back to individuals which is time consuming, and following up with various stakeholders causing considerable wastage of productive time.

The lack of a complete view of all the information generated during previous reliability improvement initiatives prevents the staff from developing an understanding of the equipment history that may potentially undermine their analysis leading to suboptimal resolution.

Common Issue 4: Most of the problem solving related to equipment operations often happen in an unstructured manner. People responsible for equipment usually communicate with their peers and experts inside or outside an organization to seek advice or solution. This communication takes place through telephone, videos, email, communicator, wikis or discussion boards.

Unfortunately most of the ideas, key observations and insights during these collaboration activities are not always captured in a structured format. This precious knowledge is lost or remains trapped in silos when the staff carrying it either retires or moves to different roles, locations or organizations.

Impact: The staff is not able to develop in-depth understanding of equipment history and past issues which undermines quality and depth of their analysis leading to suboptimal resolution.

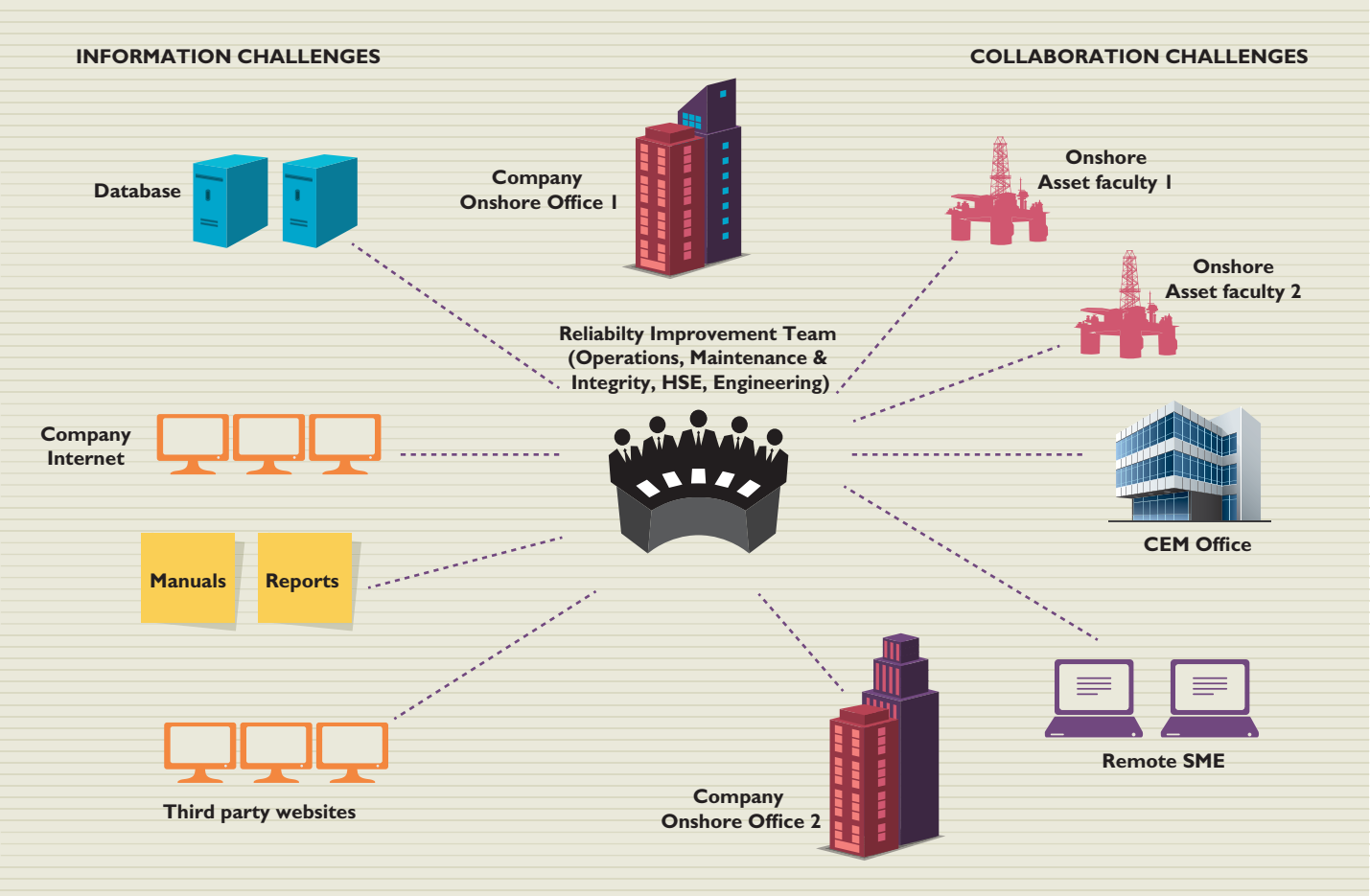

Fig: Information and collaboration challenges in reliability improvement program

Business Case for Reliability Improvement Process Transformation

In the previous sections we listed the most common issues occurring during the reliability improvement process. Though the extent of impact of these issues may vary, all of them can severely hamper efficiency and effectiveness of reliability improvement initiatives that ultimately results in late restoration of equipment or recurrence of the defect with associated financial and regulatory cost.

Based on our experience with several large business process transformation initiatives, we believe large gains in process efficiency and effectiveness of RIP can be realized through a transformation initiative that systematically identifies and eliminates these issues.

However this would require a credible business case to convince the management to sponsor a RIP transformation program which could be a significant undertaking involving multiple complex work streams and critical organization resources.

Below we present an approach to develop a business case to communicate the business value of including RIP in an organizations' transformation agenda. We have used our hypothetical scenario presented in the beginning for illustration.

An illustrative business case

An efficiency gain in RIP would mean early restoration of equipment to its original throughput, thus saving on deferment due to removal of constrained production. An effectiveness gain is reduction in failure frequency (e.g. increased MTBF) of equipment leading to reduced immediate deferment and costs of repair or replacement.

Working example: In our hypothetical case, deferment due to equipment breakdown and constrained production is 15000 barrels and 3000 barrels per day respectively. With respect to that, we have assumed the following:

- three days for equipment repair
- USD 100,000 for replacement cost of faulty seal
- 50 days for completion of equipment reliability improvement initiative
- 100 USD per barrel as crude oil price

Based on the above, a modest 10% (five days) improvement in RIP efficiency would result in a one-time saving of USD 1.5 million due to early removal of constrained production.

In addition to that cost of one time failure is USD 4.7 million which could have been potentially saved assuming that a highly effective RIP would prevent recurrence of similar failure within MTBF.

In this case, a total one-time value for single equipment is approximately USD 6 million which does not include man power cost and HSE implications.

E&P organizations possess a large number of critical equipment across their assets. Based on our experience with similar process improvement initiatives, the potential efficiency gains could be as high as 30-50% due to process standardization and automation.

If we consider these two factors we believe that actual gains could be higher by many orders of magnitude. Efficiency gain would require lesser resources to conduct reliability improvement activities thus freeing up critical staff time to focus on other value generating activities.

Overall we believe that there is a significant business case for RIP transformation.

Key Principles to Achieving Successful RIP transformation

Once a business case is established a formal charter for the transformation program should be established with complete support from the management. Here we list some key principles that seem common to successful business process transformation programs we have been involved in. We believe these will help E&P organizations achieve the maximum value from their RIP transformation initiatives as well.

a. Adopt a program centric approach to ensure alignment with business goals

RIP transformation contains multiple work streams related to workflow standardization, collaboration, information and knowledge management. Addressing each work stream as a separate project would entail the risk of misalignment with larger business goal apart from wastage of synergy between different projects. RIP transformation should adopt a program-centric approach that bundles various work streams into self-contained packages with common governance and a shared pool of critical resources to achieve synergy and alignment with business goal. Program governance should be similar to what is followed for any other successful business process transformation initiative with a balanced mix of representation from various key functions.

b. Formulate an implementation staircase to address program complexity

Given the unclear scope and high complexity of work streams, the business should develop an implementation staircase that delivers well defined business outcomes in a phase wise manner. This will help gain clarity and build confidence in the early phases of the program and secure buy-in from the end-user community.

c. Identify synergies with existing operational improvement programs to optimize program execution

The implementation staircase can be optimized by seeking potential synergies with ongoing transformation initiatives elsewhere in the organization. For example many E&P organizations have advanced collaborative center programs that include business process standardization and IT enablement as key components. By extending the scope of such programs to include reliability improvement process, a lot of cost and time can be saved by realizing economies of scale.

d. Identify quick-win opportunities to accelerate the program timeline

The business should look for opportunities in the ongoing projects to accelerate some of the components in the implementation staircase. This would work best in the cases where trials are being conducted for a new system in the organization. For example if there is a workflow automation solution being proposed, a proof of concept could include reliability improvement process to assess technology feasibility and save future efforts on technology selection and pilots.

e. Identify key IT enablers and appropriately address them in Enterprise IT Architecture

Given diverse information sources (both structured and unstructured), seamless integration of information and knowledge into reliability improvement process could be a complex IT undertaking. Many local IT projects initiated to address these issues could not sustain themselves due to lack of enterprise support, inconsistent design and high maintenance cost.

Organizations should build an appropriate level of flexibility in the enterprise information architecture design itself to address unique information requirements for RIP with guidelines for fit-for-purpose standards and technologies. This could be ensured by including RIP in the business capability blueprint that information architecture seeks alignment with. Architecture governance should also address other program IT enablers related to collaboration, workflow management and knowledge management in a similar manner.

This would help the program team save time and effort in assessing and selecting technical solutions for key IT enablers of the program.

f. Secure right skill set for program to build credibility

Any business improvement initiative requires the right skill sets to deliver various stages of program such as assessment, blueprinting and implementation. The program should be staffed with resources with a strong background in program management, business process consulting, IT architecture design, data management and change management.

Based on our experience having a strong team helps build credibility of such program in the organization and brings quality and best practices to program deliverables. If required, business should seek outside help to augment their in-house team.

Conclusion

The paper talks about the importance of Reliability Improvement Process (RIP) and common issues that hamper efficiency and effectiveness of RIP. We also presented value potential of RIP transformation using an illustrative business case. We believe that a transformed RIP can consistently provide the following business benefits:

- Reduce cycle time of equipment reliability improvement initiatives
- Early or accurate identification of opportunities for reliability improvement
- Improved reliability of equipment by improving MTBF (mean time between failures) of components
- Improving the performance of the overall asset by optimizing surrounding equipment that may provide benefits in the form of reduced fuel consumption, waste recycling etc.

A good starting point for organizations should be to conduct a feasibility study to understand the maturity of their existing RIP and potential gains from achieving target transformed state of RIP. A feasibility study should review previous reliability improvement initiatives and their outcomes. Once a business case is established, the senior leadership should commit necessary organization resources and provide their full support for the transformation program. With that, organizations would do well to observe some of the key principles listed by us to avoid pitfalls and maximize value from the transformation program.

About the Author

Hemant Kumar is the India upstream oil & gas practice head with Wipro's ENU business unit. His focus is building an industry aligned domain, differentiated solutions and competencies in the areas of Digital Oil Field, Petro technical Services and upstream Data Management. Hemant has over 12 years of upstream industry experience in both core and consulting domains with significant experience in Production Operations, Surveillance & Optimization and Well & Reservoir Management. He has a broad consulting experience with O&G Super Majors, Indepdendents and NOCs in Business Process Transformation, Digital Oil Field & Data Management. Hemant has a degree in Mechanical Engineering and MBA in Operations & Marketing.

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