CHALLENGES FACED BY TYPICAL E&P COMPANIES

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ABSTRACT

Most Exploration and Production (E&P) companies or departments in the petroleum industry face significant compression in resources – both staffing and funding. This pertains to both majors and independents. These organizations are challenged to produce more oil and gas, under more difficult conditions, often requiring advanced artificial lift techniques, at lower costs, and with smaller and less well trained staffs.

This paper presents an approach known as GRASP for strategic analysis and enhancement of typical E&P organizations. The GRASP method highlights the **G**oals, **R**esources, **A**ctions, **S**tructures, and **P**eople that such organizations must have (or acquire) and effectively deploy to successfully compete in the modern E&P environment.

GRASP analysis can be used to address such difficult business/organizational questions as:

What are the optimal:

- Organizational structures for surviving and thriving in the modern E&P business environment?
- Tradeoffs in satisfying financial shareholders, employees, suppliers, and external stakeholders?
- Interfaces and interactions between the separate departments and/or groups in the organization?
- Allocations of people and financial resources to achieve optimum productivity?
- Degrees of staff development and training for optimum performance?
- Balances between primary and secondary recovery to optimize economic operation?
- Type(s) of artificial lift for most effective production of primary and secondary reserves?
- Approaches between manual and automated operations?
- Plans and funding mechanisms for new equipment vs. repair and maintenance of existing equipment?
- Investments in resources for safety and environmental protection?

GRASP analysis is based on a sophisticated causal (cause and effect) evaluation of the organization and its important issues. The evaluation is augmented by several technological tools that clarify areas in the business where leverage is needed and can be applied to make significant improvements.

While many issues can be studied with GRASP, this paper focuses on how it can be used to enhance the application of artificial lift. Artificial lift is a general term used to describe the body of technology used to produce oil and gas wells that will no longer produce at acceptable rates by natural flow.

INTRODUCTION

Most upstream exploration and production (E&P) companies or departments in the petroleum industry are facing a tremendous confluence of pressures. A significant compression in internal resources is forcing these companies to attempt to pro-

duce more oil and gas, under more challenging conditions, often requiring advanced artificial lift techniques, at lower costs, and with smaller and less well-trained staffs.

Declining reserves and increasing depletion rates of existing assets are focusing much of management's attention on finding ways to maximize economic recoveries. In many cases, the "hay day" of free flowing production is over. Maximizing economic production requires that the organization optimize the selection, design, installation, and operation of its artificial lift system(s).

Often this focus on artificial lift requires that the organization invest in significant levels of (often new) technology. It must develop people that are capable of effectively selecting, designing, installing, and operating this equipment. And, it must implement effective means for maintaining these systems.

For some companies, the challenges of artificial lift are new. Many other companies have been using artificial lift systems for many years. But in both cases, there are significant opportunities for improvements. Some important questions are:

- What is the most appropriate type of artificial lift for the particular field under consideration?
- What is the most appropriate strategy for acquisition of the necessary systems – purchase, lease, other?
- What types and numbers of staff are needed?
- Which aspects of the system management should be outsourced; which should be performed by in-house staff?
- What training is required to allow these staff members to be most effective? When do they need this training?
- What strategies should these staff members employ for optimum artificial lift selection, design, installation, operation, and maintenance?

These questions must be considered within the context of the overall organization. The organization must face many issues such as those briefly outlined in the abstract. It cannot address one set of questions in isolation from the others without risking significant gaps, overlaps, and losses in overall effectiveness. To effectively deal with these multiple issues, a decision analysis framework is required. For this, a new approach that can help articulate and analyze the role of artificial lift in the complex world of a modern E&P organization is a process known as "GRASP."

"GRASP" refers to a practical yet robust process that can help management identify, align, and leverage strategic operating resources within the area of artificial lift, while also helping to optimize resources across other E&P areas, as well as with stakeholders outside of the organization. GRASP articulates and evaluates the **G**oals, **R**esources, **A**ctions, **S**tructures, and **P**eople that such an organization must have (or acquire) and effectively deploy to successfully compete in the modern E&P environment. By using this process, the role of artificial lift within the E&P environment can become both clear and attainable.

WHAT IS GRASP?

The GRASP process provides a rigorous yet practical way for managers and their teams to systemically understand and coordinate the complex issues of artificial lift (or any other issue) within the E&P environment. Usually, managers talk about goals in one setting, resources and actions in another, and personnel issues in yet another. But these conversations all focus on different aspects of the same challenge, how to motivate individuals to be personally committed to doing what is most important for themselves and the organization, when and where it most needs to be done.

This challenge is felt across all organizations, not just oil and gas companies. GRASP helps leaders and their teams integrate and align their different but closely related objectives. To facilitate this effort, GRASP is a structured way to integrate the goals, stakeholders, resources, actions, structure, and people of an organization, as seen in Figure 1.

APPLICATION OF GRASP IN THE E&P ENVIRONMENT

Figure 2 shows an example of how GRASP has been used to help analyze a typical E&P problem. This is included as an example before exploring the application of this technique to artificial lift in more detail. In this actual case study, geologists,

geophysicists, drillers, reservoir managers, facilities experts, financial analysts, government representatives, and marketing analysts came together to evaluate the technical and economic feasibility of an offshore development opportunity.

The question on the table was whether to renew an existing concession and prove the necessary reserves to justify investment in developing the concession before it would expire in a few years, or to do nothing and back out. A significant downstream potential existed for this opportunity, yet it depended on proving this reserve. Several key challenges added additional complexity to the analysis, such as extreme drilling depth, long distance from shore and from downstream markets, and political pressures from two rival markets linked to this field.

The GRASP approach helped the project team address many key challenges faster and more thoroughly than traditional approaches permit. By putting all of the key analytical pieces together, cross fertilization of ideas and understanding of technical constraints arose much more quickly than when using the usual serial process of analysis. By visually mapping the critical interdependencies that existed across and between these different stakeholders, the team members quickly saw and understood the impact that the interfaces and interactions between these areas would have on the ability for the organization to take advantage of this time-dependent opportunity.

Also, the team members quickly identified the key tradeoffs that had to be made to satisfy these different groups. For example, including government representatives from the concession-granting authority provided a key opportunity to address potential financial deal breakers during the technical feasibility phase. These included assumptions about exchange rate risk, and tax and royalty policies that are captured in the variable *Fiscal Obligations*. Items in *italics* are variables shown in Figure 2. Additionally, making the different *Government Interests* and *Partners' Interests* explicit in the analysis not only brought the parties closer together but also allowed the team to identify and resolve critical issues that usually are handled much later in the process. This saved significant time and resources for the entire evaluation process.

The GRASP approach also highlighted the need for specific staff development and training that would be required to make this project successful. Using a tool that helps identify places to act with relative leverage within the system highlighted the importance of locating specialized rigs for use in the small drilling window that was available. This was a critical piece in the evaluation of this project.

By making the impact of potential key delays explicit in the cause and effect map (Figure 2), the team realized that early commitment and coordination of specialized *Rigs on Site* would be required to enable the project to proceed. Through the system archetype analysis, another tool from the GRASP approach[i], it also became apparent that a long, internal financial approval process inside the concession-holder's company could jeopardize the success of the project, despite the technical feasibility.

These realizations emerged from a new way of working together in a more integrated way. One of the key outcomes was the development of a process that took much less than half of the normal 12 to 18 months it usually takes for evaluating an upstream project. The analysis took approximately one month of intensive, full-time work together, and the decision to go forward or not took another four months.

GRASP APPLICATION IN ARTIFICIAL LIFT

Figure 3 shows how GRASP can be applied to gain significant insight into the application of artificial lift in a complex E&P organization. The example shown is hypothetical; but important lessons can be drawn from this "straw man" analysis.

The GRASP analysis is helpful in bringing together in one place many of the key reasons why artificial lift is so critical to optimizing oil and gas recovery. As described in Figure 3, *Investment in Development* increases the amount of *Drilling/Workover* in order to increase the *Recoverable Oil and Gas In Field* under natural flow. However, as *Oil and Gas Production* slowly decreases the *Pressure and Flow Rates*, the *Need for Artificial Lift Technology* increases. Truly effective reservoir management and optimization of producing fields is greatly enhanced through the use of artificial lift technology.

The importance of *Artificial Lift Expertise* to take advantage of the benefits artificial lift offers cannot be overstated. This expertise is critical in making the best selection of the technology provider as well as the best design and application of the technology itself. These decisions must be based on the conditions in the field of interest and must be able to optimize current production and ultimate recovery as the reserves in the reservoir(s) being produced deplete with time. The selected system(s) must also fit into the existing operating environment of the company.

As described in the map (Figure 3), it is imperative to consider the *Need for Qualified Staff* able to select and handle the appropriate artificial lift technology. Improving the application and use of existing technology as well as keeping pace with the newest developments in artificial lift are key challenges for management. In addition to maintaining their own employees' technical skill through *Training Staff*, the artificial lift managers must also be expert in balancing the mix between *Hiring Staff* and *Contracting Consultants.* These are the people charged with ensuring the appropriate *Artificial Lift Installation Quality* and the *Quality of Artificial Life Use and Maintenance* are achieved in order to minimize *Downtime*, thereby safely maximizing *Oil and Gas Production*. This is how artificial lift, in terms of GRASP, contributes to ensuring optimum operating and financial performance over the long term.

BROAD APPLICATION OF THE GRASP PROCESS

GRASP analysis is based on a sophisticated causal (cause and effect) evaluation of the organization and its important issues. There are only a few key steps in the GRASP process. Each step is augmented by several technological tools that clarify areas in the business where leverage is needed and can be applied to make significant improvements. Table 1, at the end of the paper, lists the various technological elements of the GRASP process. Here, we present a brief description of each of these tools and how they can be used to add value and insights to the analysis.

The first step of the process, System-Wide Discovery, captures the key cause and effect relationships. Figure 3 represents a view of many key cause and effect relationships in an E&P company that uses artificial lift technology. A clear line of sight is established between what the operating area can actually do, their Actions, the Resources they have to do their work, and the different stakeholders they have to satisfy by doing this work over time.

By making these connections, the different tradeoffs and valuations can be addressed by the management team in one consistent context. For example, it is critical to keep the level of artificial lift expertise high in order to ensure the best application of artificial lift technologies. Many companies choose to outsource this to service companies or consultants. However, as the use of artificial lift technology increases, the balance between hiring and training in-house personnel and using outside consultants will be a critical decision that will affect long-term financial results.

Often it is important to understand a piece, or subset, of these connections in more detail. The second step in the process, Key Resource Dynamics, permits the management team to take a key variable, such as *Oil and Gas Production Rate*, and look at how the different elements that affect this variable interact over time (see Figure 4).

For example, maintaining the target production rate in a production operation requires effective use of artificial lift technology. Different technologies are available and, depending upon the conditions of the specific field in question, some technologies are more appropriate than others.

Using the key resource dynamics tools provides insights into this evaluation, comparison, and selection. In the example above, the relative time to implement and the effectiveness of the technology selected are the two key factors that could be analyzed.

To obtain a more holistic understanding of how each of these key resources interacts with the others, an integrated simulator can be built (Figure 5). The importance of using a dynamic simulator like this is to check for unintended consequences that occur when a well-intentioned action in one area negatively affects other, apparently disconnected areas. It is often difficult for management to determine which type(s) of artificial lift technology to apply and when to apply it, since a major focus of their attention may be on other exploration and production programs or problems.

In the third step of the process, using an integrated simulator allows management to compare the financial impacts of different operating decisions before actually committing company resources. By establishing a numeric relationship among the connections made in the GRASP map in the system wide discovery phase, the team can easily make and test many hypotheses concerning how much of which combination of technologies makes the most sense for a particular field of interest. This also helps flesh out differences in assumptions and understandings about how the alternative technologies actually work.

If the simulator is to be used as a tool for more formal planning in the organization, it may be designed to include a flight simulator interface. Figure 6 shows a simple example of this type of interface. It provides a clear mechanism for providing participants in the planning process, who may not have been part of the model building, an easy way to look at the alternatives, make and test different hypotheses, and see the results of their hypotheses in familiar ways. This tool facilitates management processes such as strategic planning and scenario planning. The graphical outputs help describe the outcomes over

time of a particular set of decisions. In this case, the production curve is a product of initial natural flow production and decline, followed by a rebounding curve that is a function of implementing artificial lift technology.

These models with flight simulator interfaces may also be used to educate other company staff about the challenges management is facing. These learning environments allow management to not only share with the rest of the organization how they have thought through key decisions that affect the organization but also to invite company members to try new ideas of their own and to discuss the outcomes in a safe environment. This is good both for individual professional development as well as for organizational development.

This simulation would be designed to help management look at complex issues involved in this technology such as when to apply artificial lift, how aggressively to apply it, and how to maintain it effectively over time. Other issues to include would be when to apply secondary recovery and how to evaluate its impact on artificial lift needs and performance.

APPLICATION OF GRASP IN AN E&P ORGANIZATION

Table 2 lists a number of typical E&P issues that can be analyzed with the GRASP process. Application of the GRASP process as it is described in this paper is not difficult. It can be accomplished by following the steps detailed in Table 1. However, most companies find that to apply it successfully, it is necessary to obtain specific training in the process, or in some cases, outside expert assistance. Both are available to those who are interested. An initial "awareness" training exercise requires two or three days and can be conducted in a company's office. After initial training, the company personnel can decide if it will be worthwhile to pursue use of this technology, and how best to do this.

CONCLUSION

The GRASP approach is being presented in the business literature as a way to understand the complexities of any modern organization. It can be effectively applied to any size E&P organization, and it can be applied within an E&P organization to address such complex issues as the optimum choice and application of artificial lift systems.

REFERENCES

1. J. L. Ritchie-Dunham and H.T. Rabbino. 2001. *Managing from Clarity: Identifying, Aligning, and Leveraging Strategic Resources*. Chichester: John Wiley & Sons. This book presents a more complete description of the GRASP approach, methodology, and tools.

2. H.T. Rabbino and Dunham, C.L. 2003. *Optimizing the Organizational Design of a Typical Upstream Exploration and Production Company*, SPE 84437**.** SPE Annual Technical Conference and Exhibition held in Denver, Colorado, USA, 5 - 8 October 2003.

Table 1
The GRASP Process
Using the Advanced Analytical Tools to Take Systemic Understanding Further

GRASP Process	Typical Value Added / Impact Insights
System-Wide Discovery • Construct the GRASP causal maps that present the relevant relationships among key stakeholders and the organization's resources. • Create a common understanding across leadership teams of the potential impacts these interdependencies have on performance over time.	• Capture, integrate, and analyze mental models of the entire process. • Identify areas of high systemic leverage that can be addressed. • Identify those areas of low leverage where investment of significant time and resources may not be warranted. • Develop a shared analysis of the available resources.

GRASP Process	Typical Value Added / Impact Insights
Key Resource Dynamics • Explore the often-counterintuitive behavior inherent within the drivers of dynamic behavior for each key resource.	• "Free lunch" analysis – identify the limits to success for each key resource. • Develop shared understanding of key drivers for each resource – usually more than the perspective of any one person.
Resource Integration Simulation • Quantify and connect the key resources, thus permitting testing of proposed alternative actions.	• Use "war gaming" to test management awareness of intended and unintended results from their decisions, in a safe environment.
Scenario Planning • Investigate critical concerns across a range of possible futures, as well as the organization's potential ability to survive and thrive in such environments.	• Test rigor of existing and possible paradigms and policies. • Provide sustainable systemic leverage.
Learning Environments • Provide a vehicle for communicating the logic and drivers behind the desired policies and actions that arise from the systemic analysis and planning.	• Communicate to stakeholders how their goals and structures affect their own performance and that of others.

Table 2
Application of the GRASP Process to
Typical E&P Challenges

Aspects of modern E&P organizations that required optimization	The GRASP process can help organizations realize how to focus on:
Organizational structures for surviving and thriving in the modern E&P business	• Managing hydrocarbon assets including exploration, production, secondary/tertiary recovery, and cost containment, in one initiative. • Developing and communicating essential objectives, processes, and best practices across the organization. • Developing consistent approaches for staff selection, development, and training for all functions.
Tradeoffs in satisfying financial shareholders, employees, suppliers, and external stakeholders	• Developing the long-term view - appropriate investments are required today for significant future gains. • Realizing that shareholders and employees need both short-term returns and long-term possibilities. • Realizing that suppliers must be members of the team, not the enemy. • Realizing that external stakeholders must often benefit culturally and socially, as well as financially, from the relationship.
Interfaces and interactions between the separate groups in the organization	• Integrating the global goals at the organizational level and the local goals at the work group level. • Appreciating how each group contributes to both local and global goals. • Appreciating how activities in each group affect each

Aspects of modern E&P organizations that required optimization	The GRASP process can help organizations realize how to focus on:
	other group and the organization as a whole.
Allocations of people and financial resources to achieve optimum productivity	• Highlighting the importance of each function that is essential to the global and local goals. • Developing recognition and reward systems to encourage active participation in all-important functions, not only the ones with high "appeal."
Degrees of staff development and training for optimum performance	• Insisting on staff development processes that optimize staff knowledge and performance. • Recognizing and rewarding staff in a way that enhances their performance through successful development and training processes.
Balances between primary and secondary recovery to optimize economic operation	• Understanding opportunities for economical secondary and tertiary recovery. • Investing sufficiently in secondary/tertiary recovery technology, and in the staff development and training that is necessary for its success.
Type(s) of artificial lift for optimum production of primary and secondary reserves	• Understanding the optimum type(s) of artificial lift systems to optimize the economic recovery of primary and secondary reserved. • Determining the optimum type(s) and levels of staff to most effectively deploy this technology.
Approaches between manual and automated operations	• Understanding and taking advantage of the significant economical and operational benefits available with effective production automation - in terms of enhanced recovery, reduced operating and maintenance costs, improved staff effectiveness, and improved safety and environmental protection.
Planning and funding for new equipment vs. repair and maintenance of existing equipment	• Understanding and applying the economic advantages of effective equipment repair and maintenance - predictive and preventive as well as reactive.
Investing resources for safety and environmental protection	• Recognizing that people and the environment are our most important resources and providing for their safety and protection before all else.

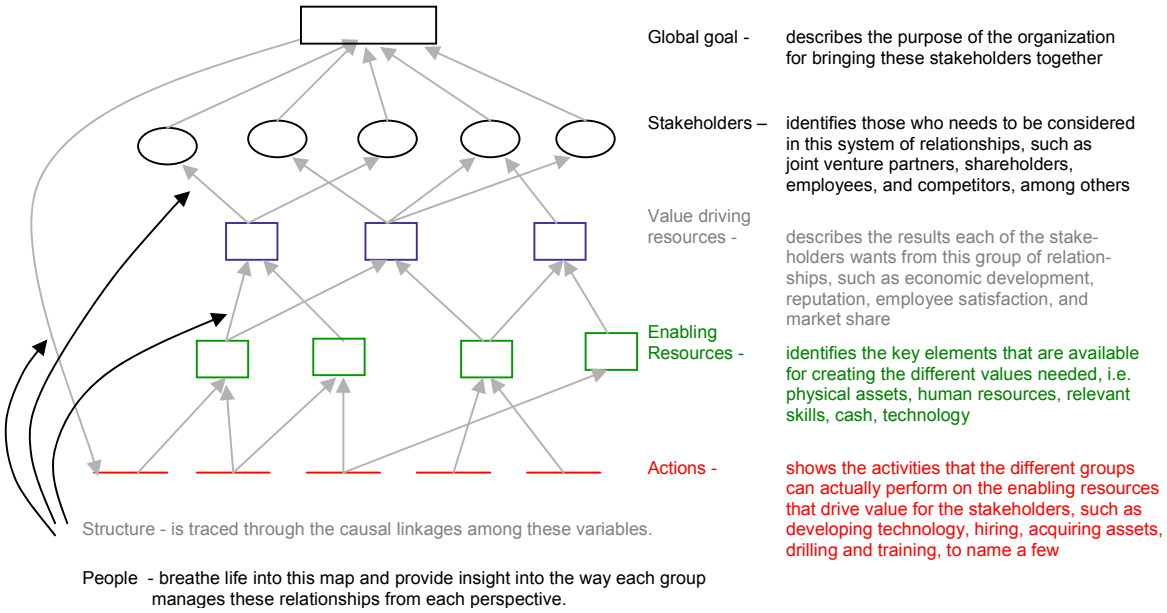

Figure 1 - Structure of the GRASP Process

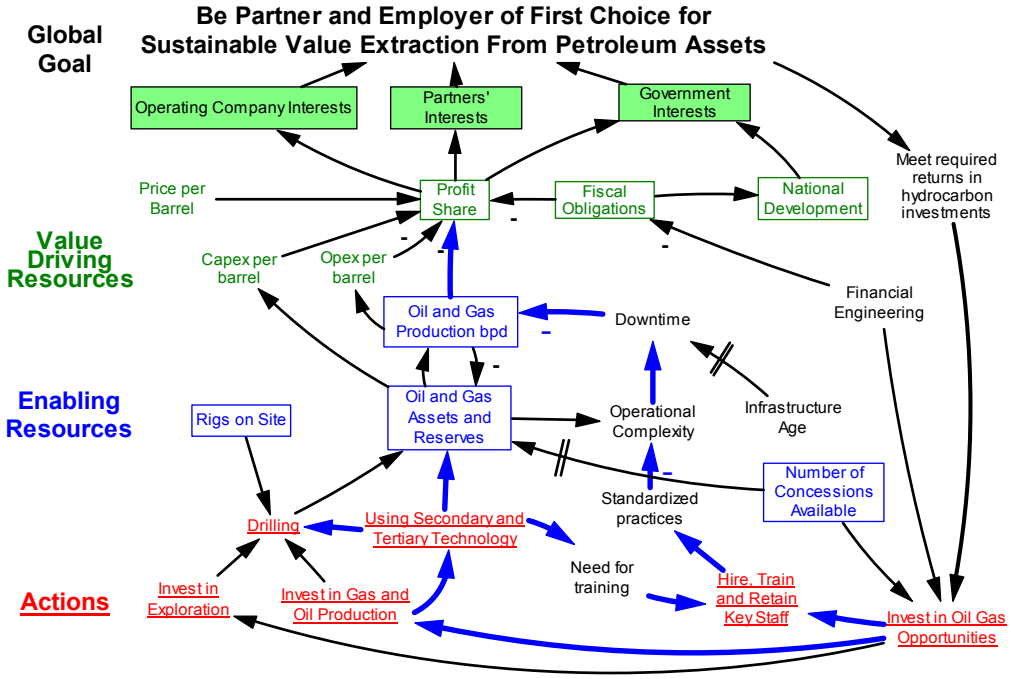

Figure 2 - High Level GRASP Analysis in E&P

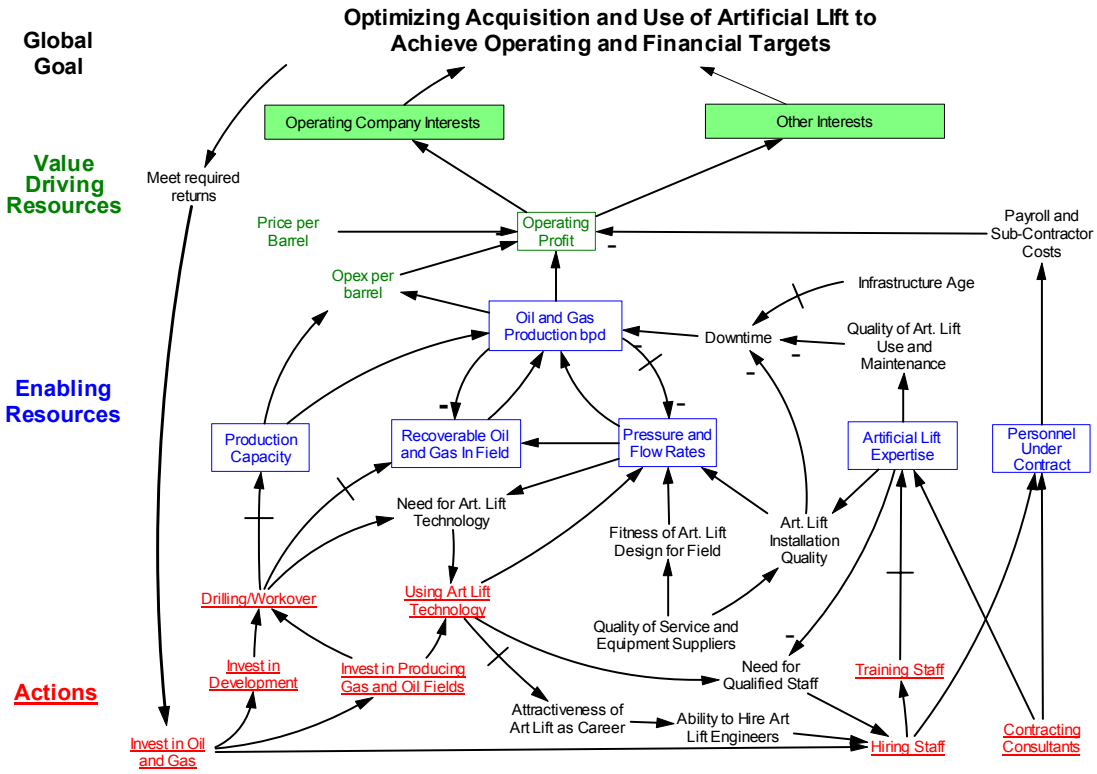

Figure 3- High Level GRASP Analysis and Artificial Lift

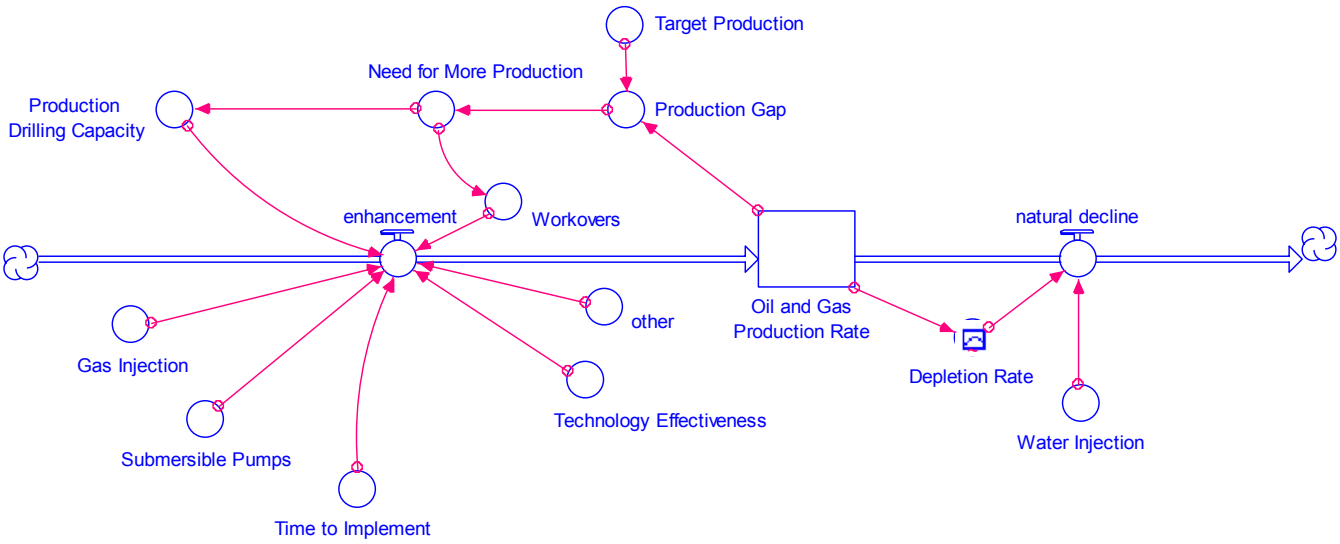

Figure 4 - Key Resource Dynamics

Figure 5: Resource Integration Simulation

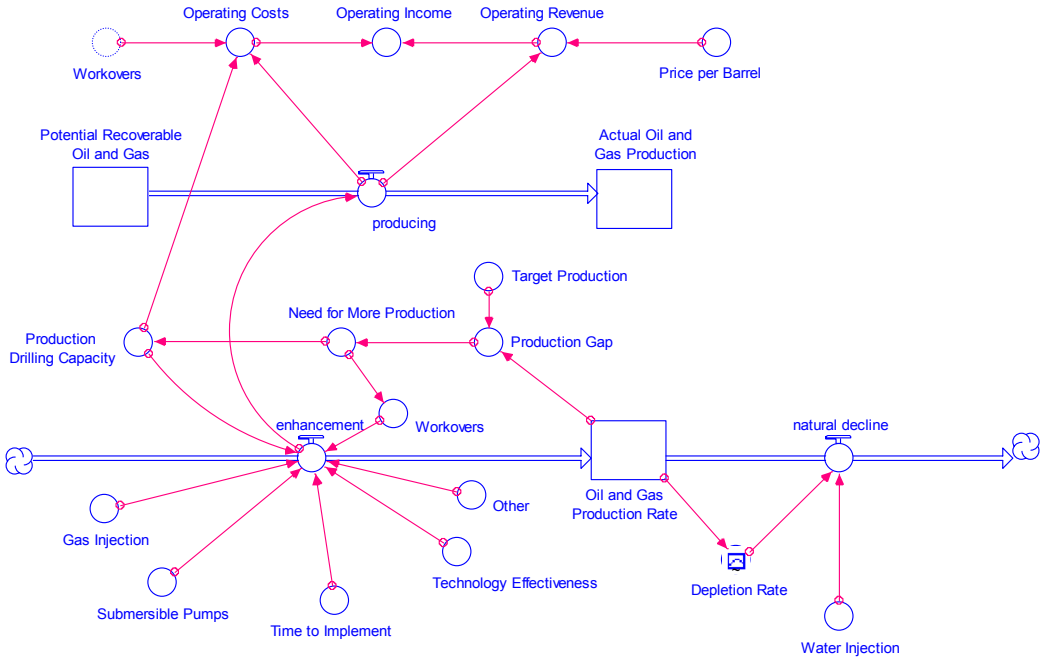

Figure 6: The Integrated Simulator for Scenarion Planning and Learning Environments