RIG COUNT

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Introduction

Rig count is essentially exactly what it sounds like, a tally or count of rigs. This census is utilized by those ranging from petroleum service companies to state and U.S. legislators. "For example, Wall Street analysts use this number in their profit projections for oil service companies. State legislators use this number to assess whether their drilling incentive programs remain competitive with other states."[c] When it comes to analyzing drilling activity, rig count is a simple and accurate method. In fact, it is widely used due to this simplicity. Rig counts are frequently used but are all too often abused. Rig Count is a good indicator for many factors. Nevertheless, it is utilized both where it is applicable and where it is not. Still, rig count makes sense. It is a present and solid gauge for drilling activity. For a procedure mostly carried out below the surface, it is a tangible and visible marker for a mostly invisible process. The rig is either up and active or inactive and/or down. Both the technical and non-technical can understand rig count. The information is constantly updated and accurate. Rig count overcomes language and unit system barriers, and is used worldwide. But there is a problem, with ease comes widespread use, and with widespread use comes misuse. In its simplicity, rig counts cause valuable information to be overlooked or ignored. This information can range from well depth, local geology, type and volume of hydrocarbons produced to well/drilling costs, all of which affect production, and most importantly, net profit. For example, in 2006, the monthly average rig count in the U.S. was 1,649 rigs. However, that same year, in the entire Middle East, the monthly average rig count was only 238 rigs. If one were to use rig count as an indicator of production, like it often is used, one would conclude that the Middle East is not a big producer. It is common knowledge that the Middle East is, in fact, a big producer of petroleum. The Middle East is home to over half of the world's proven oil reserves. In 2006, Saudi Arabia alone produced approximately 10.7 million barrels of oil per day while the entire U.S. produced only 8.3 million barrels per day. In addition, Saudi Arabia only contributes about 40% of the Middle East's petroleum production.

Needless to say, conclusions drawn from the rig count may need to be drawn more carefully. When counting rigs, one rig is considered equal to another. A 3000 ft. well in Colorado, an 8,000 ft. well in Texas and a 20,000 ft. Louisiana well would each count as one rig and be observed as equal to one another in a simple tally. When we use rig count, one rig that ends up producing 50 bbls per day or another producing 8,000 bbls/day is considered the same as one later producing 100,000 bbls/day. When most people see a drop in active rigs for their state or region, the first thing that may come to mind is that their state is not producing petroleum as well as a neighboring state or region whose rig count increased. This is not entirely accurate. Rig counts should not be considered equivalent to production or reserves as they sometimes are. These rig counts only represent drilling, the primary stage of activity during which the well is not producing. Though they represent drilling activity accurately, there's no benefit if this activity results in a dry hole. The purpose of this report is not to deem rig count inaccurate and useless, but more so to deconstruct and examine the parameter and inform readers where and when it is appropriate to use rig counts.

Rig Counts: Past and Present

The present representative of petroleum drilling activity in the United States and internationally is rig count. This statistic has been used by the technical and non-technical alike for roughly 60 years. Rig Count is defined by Baker Hughes as "a weekly census of the number of drilling rigs actively exploring for or developing oil or natural gas in the United States and Canada." [b] Baker Hughes is a leading provider of drilling, formation evaluation, completion and production products and services to the worldwide oil and gas industry.[i] Baker Hughes, Smith Tools, and a number of other companies supply rotary rig counts as a service to the petroleum industry. Though Baker Hughes and Smith Tools lead the pack, the Baker Hughes rig count is substantially more widely used. This is due both to their long history of documentation and clearly defined guidelines for how to count active rigs.

How it works: Details and Guidelines

First of all, there is a difference between a rig and a well. The word rig refers to the surface equipment used to drill the well. It includes the derrick, the mud pumps, tanks, and pits, the top drive (large hook-like unit hanging inside derrick, used to put weight on the bit), and the rotary table (turns the drill string and the bit attached to the bottom). A well is the actual hole that the rig drills. After the rig has drilled to the required depth, it will move off site leaving the well, topped by a wellhead. A wellhead is a series of valves and pressure gages that allows control of flow and production of the formation fluids. The wellhead also allows access to the tubing. After the well has been drilled and a wellhead is in place, most wells will produce on their own during the first phase of production life due to the pressure difference between the surface and the bottom of the hole. Others may not have enough of a pressure differential and may need help from surface pumping equipment or secondary recovery methods (discussed later in this report).

"Other companies define activity differently than Baker Hughes, and their counts may include rigs that are available or contracted, but not actively drilling. These counts provide a census of rigs available for work rather than those actually working."[b] Therefore, in this report, we shall treat the Baker Hughes rig count as the standard. North American rig count data is scheduled for release at noon central time on the last working day of each week. The international rig count and North American workover rig counts are scheduled for release on the 5th working day of the month.[i] Baker Hughes (then Hughes Tool Company) began weekly tallies of drilling activity in the US and Canada in 1944, and internationally in 1975. The company introduced its monthly workover rig count in 1987.[b] A workover rig is basically a scaled down drilling rig used not only to increase production of a producing well, but also to perform extensive repairs to the well. A workover includes any work performed to modify the producing zone in a well, to clean out, or reach an old producing interval.[a] Baker Hughes defines that a workover occurs "when the operator has pulled production tubing from a well that is 1500’ or more in depth.” [b] Baker Hughes, very recently (June 2007), decided to discontinue their workover rig count. The June 2007 count will be the last workover rig count released by Baker Hughes, though archived information will continue to be available on their website. The company gave insight to the reasons behind their decision, stating that “the wealth of industry information that was available from other sources” was considered.[b] Baker Hughes will continue to compile and report the Baker Hughes Rotary Rig Count. To be considered active by Baker Hughes, the rig must be on location and drilling (rotating to the right or clockwise). A rig which meets the preceding conditions will be counted as active from the moment the well is “spudded” until it reaches target depth or “TD”. The verb “spud” is defined by the Schlumberger Oilfield Glossary as “To start the well drilling process by removing rock, dirt and other sedimentary material with the drill bit.” Those not counted as active by Baker Hughes include rigs in transit between locations, rigging up, or those being used in non-drilling activities including completions, workovers, or production testing. A rotary rig is termed by Baker Hughes as a rig which “rotates the drill pipe from surface to drill a new well (or sidetracking an existing one) to explore for, develop and produce oil or natural gas.”[b] Rotary drilling consists of pressing the teeth of the drill bit against the ground and turning or rotating it.[a] However, non-rotary rigs may be included in the count based on how they are employed. Consequently, coiled tubing (one long, flexible tube that can be used as drill pipe) and workover rigs that are employed in drilling wildcat or new wells are included in the count.

Figure 1

2007	
State	**Average Rig Count**
Alaska	8
California	35
Colorado	107
Louisiana	177
New Mexico	78
Oklahoma	188
Texas	834
Wyoming	74
Total U.S.	1769
Total Middle East	265
Saudi Arabia	77

Source: bakerhughes.com

What Rig Counts Tell Us

There are many proper applications for rig count data. In addition to rotary or workover status, rig count indicates where and how many rigs are active. Baker Hughes provides many subsets of the total weekly US rotary rig count.[b] With this additional information we can view rig counts by state and verify whether the rigs are located on land, inside inland waters, or offshore. We can also observe whether the rigs are drilling for oil or natural gas in the US. Rigs drilling horizontal and directional wells can also be studied apart from the mass. From this information we can also examine how location fluctuates with variables such as weather or regional taxes. Baker Hughes rig counts are also an important gauge for the drilling industry and its suppliers.[b] Contract drilling companies, drilling mud companies, and equipment leasing companies all reference the rig count. There are thousands of different products and services potentially necessary for an active rig. From drilling mud, drill bits, and pressure gauges to trailers, catering services and safety equipment for the crew. When drilling and/or workover rigs are active, oil industry products and services are consumed. Therefore, rig count correctly illustrates the demand for products and services provided by the oil service industry. Oilfield workers can anticipate an increase in the job market as rig counts increase. When the rig counts increase, supply and service companies may anticipate a rise in sales. "The active rig count acts as a leading indicator of demand for products used in drilling, completing, producing, and processing hydrocarbons."[b] We can also monitor how the active rig count changes with oil and gas prices. Difficult, more costly exploration may be economical when selling prices rise. Higher profit margins due to increased selling prices are an undeniable incentive to drill more wells. High oil and gas prices may leave room for secondary and possibly tertiary recovery methods in a company's budget.

Figure 2

Year	Baker Hughes Annual Average Wells Drilled	EOA Annual Production Oil + Gas (BOE)	
1970	1027	7,285,518,648	see file "Production Info - Manuel.xls"
1971	974	7,328,789,931	for individual oil and gas production
1972	1107	7,332,722,000	
1973	1196	7,257,495,745	
1974	1475	6,916,645,910	
1975	1662	6,506,156,752	
1976	1656	6,400,844,083	
1977	2001	6,445,531,207	
1978	2259	6,606,810,021	
1979	2175	6,647,333,724	
1980	2909	6,625,681,959	
1981	3974	6,568,178,524	
1982	3105	6,352,206,641	
1983	2232	6,057,023,352	
1984	2428	6,381,633,117	
1985	1980	6,224,761,772	
1986	964	6,047,750,207	
1987	936	6,027,627,110	
1988	936	6,045,916,869	
1989	869	5,882,722,724	
1990	1010	5,878,033,786	
1991	860	5,880,603,979	
1992	722	5,816,877,159	
1993	754	5,740,636,172	
1994	755	5,793,785,483	
1995	723	5,718,339,545	
1996	779	5,738,245,276	
1997	943	5,732,758,655	
1998	843	5,704,884,872	
1999	625	5,539,566,080	
2000	918	5,570,233,448	
2001	1156	5,634,919,310	
2002	830	5,491,072,193	
2003	1032	5,498,020,690	
2004	1192	5,316,838,717	
2005	1383	5,126,766,131	
2006	1649	5,187,659,372	
2007	1768	5,283,346,428	

Figure 3
Percentage of Successful Wells (1949-2005)

What Rig Counts Don't Tell Us

Production

Though rig counts provide plenty of information about drilling activity, they don't tell us about many other important things. For instance, a simple count of operating rigs does not tell us anything about production, drilling success rate, or the economic potential of the area being drilled. When a particular rig is counted by Baker Hughes, it is actively drilling only. It is not producing. In order to produce, a well must drill to the planned depth of the reservoir. The casing must be set, and the necessary completion operations must be conducted long before a well can produce. Once a well is producing, the actual rig and surface equipment are long gone and a wellhead sits atop the actual hole. We may not see production from a particular active well until months after the actual drilling took place. In addition, after all of the money spent on drilling a well, the well may not produce at all. This is called a "dry hole" and is a fairly common occurrence in the oilfield. For months, while this well was being drilled, it was being counted as active only to produce nothing. However, some wells that do not produce were never intended to. Injection wells, appraisal wells and some exploration wells are not drilled for the purpose of production. These injection wells are used in secondary recovery methods to maintain reservoir pressure so that a production well nearby can continue to produce or improve existing production. Injection wells inject water and sometimes gases into the formation to help push the formation fluids toward a producing well, helping it to bring oil and gas to the surface. Injection wells can also serve as disposal wells for water that is produced with hydrocarbons. Some exploration wells are intended only to gather geological or geophysical information from the area for the purpose of drilling other producing wells.

Depth

The rig count also does not include depth information. TD is how deep the well has to drill to reach the producing zone. The rig count only tells us that the rig is there and actively drilling, not how deep it is going to drill. The amount of time that a rig is active can depend largely on TD. The deeper a rig has to drill, the longer it will be on location and active. Furthermore, the deeper a well, the slower the penetration rate of the bit. This means that the rig is active for much longer. This depth information also correlates to another parameter that rig count fails to tell us, cost.

Cost

Cost is a very important statistic in the oilfield. Production can be high, but when cost is introduced, the net profit margin may not cut it. Average costs are generally measured in cost per foot and vary by region and depth. The cost of drilling escalates with depth, both the average cost per foot to a total depth, and the incremental cost per incremental foot drilled. Also, with depth comes higher subsurface temperatures and pressures which can create the need for more costly safety measures and equipment. For instance, a 10,000 to 12,499 ft. oil well in South Louisiana costs an average of $211/ft., while a well of the same depth in North Louisiana costs an average of $123/ft., and one in Wyoming costs an average of only $65/ft. In addition, a deeper well drilled from 17,500 to 19,999 ft. in South Louisiana costs an average of $234/ft. As shallower fields continue to deplete, oil and gas companies are likely to continue to pursue deep drilling prospects to maintain or increase their production levels. While demand for land rigs capable of drilling greater than 15,000 feet has grown significantly, the supply of such rigs is limited, contributing to rapid increases in day rates for rigs with these capabilities. "If the number of wells drilled per rig declines with depth, the cost of drilling increases with depth, and the investment in rig equipment escalates for deeper drilling, it is safe to conclude the rate of growth in number of rigs working will be lower in a deep drilling province."[c] This is a factor that should be taken into account when comparing the number of active rigs in South Louisiana with that of other states.

Geology/ Location

The geology in a particular region can have a major effect on cost, production, and duration of drilling. We cannot see the geology from a state's number of active rigs. Geologic regions spread across state lines. We have many different geological regions across the US from the Texas and Louisiana Gulf Coast to the mountainous regions to the north. Important geological parameters such as porosity and permeability play a major part in a reservoir's ability to both hold and produce hydrocarbons. Porosity refers to the percentage of the rock that is pore space, while permeability tells us how well those pores are connected. Both are needed for production. The higher the porosity, the more formation fluids a reservoir can hold. The higher the permeability, the easier it is for gas or oil to flow. The Texas and Louisiana Gulf Coasts boast high permeability and porosity, while the northern part of Texas has very low porosity. The Barnett Shale and Fayetteville Shale are home to large amounts of gas in shales with very low permeability. Costly secondary recovery methods by fracturing are a must in these regions. Acid jobs must also conform to the area's geology. Some acids can react with minerals in certain types of rocks, damaging the well. Also, the geology of the subsurface determines what kind of drilling fluids can be used. Using saltwater or certain chemicals in drilling mud can cause damage to the formation. Mud programs must be specifically tailored for the downhole geology.

The type of rock being drilled into can have a major effect on cost. In regions where abnormal pressures are prevalent, compaction can cause significantly slower rates of penetration. In areas where the reservoir rocks are typically harder, you can get rates as slow as a foot or less an hour compared to softer formations which can drill as fast as 60 ft./hr. or more. Harder formations can also cause damage to bits, which would require tripping out (bringing the drillpipe all the way out of the hole) and replacing the bit. Depending on depth, tripping out can be a time consuming process.

The geology can also require drillers to take extra steps which can cost the operation money and time. In some regions, underground aquifers must be protected by setting casing in the hole. Other regions allow for open hole drilling where no casing is required. Additionally, in regions such as the Tundra, extra care must be taken to preserve the fragile environment. Mud pits must be lined in some areas to prevent seepage into the soil and groundwater.

Location and lithology can also have an effect on what types of contaminants are in the oil or gas. Certain areas can contain more amounts of Hydrogen Sulfide, water vapor, Carbon Dioxide, Nitrogen, or other contaminants that must be removed. These contaminants must be removed before being allowed to enter the pipeline and before sale. Besides being poisonous, sulfur is extremely corrosive which is why it is imperative that it be removed before pipeline transport.

Conclusions and Recommendations

Since Baker Hughes began counting drilling rigs 70 years ago, the oil and gas companies and economists alike have used rig count to measure the health of the petroleum industry. A higher rig count implied a stable market and a declining rig count caused concern. The general conclusion drawn is that the higher the rig count, the greater volume of oil and gas that will be available for production. However, higher rig count could also hurt the industry because with increased supply, prices tend to drop. Lately, industry leaders are beginning to notice that some oilfield equipment and service companies are continuing to grow and prosper despite periods of declining rig count. Although this industry will always rely on the drilling rig, technology has advanced so much that we need fewer rigs to do the work that more would have done just 5 years ago. All in all, Rig Count is a very useful tool for drilling activity and oilfield statistics. Rig count is the perhaps the most watched index of drilling activity. When we begin to use it inappropriately is when this parameter becomes inaccurate. It is extremely common to relate rig count with production. The rig count only tells us how many rigs are actively exploring for oil and gas, not those actually producing oil and gas. For example, most would be immediately surprised by the fact that on average, in February 2008, the entire Middle East has 272 rigs running, while the entire US has 1765. This is because we immediately see production when looking at rig count. To accurately use rig count, we must take into consideration what the Rig Count can show us and what it cannot. We cannot depend on rig count to tell us about actual production. Rig count can tell us that wells are being drilled, but not how many will actually produce once drilling is complete. We have a real problem when this parameter is used for analytical and economical purposes that it cannot accurately portray or predict.

Figure 2 illustrates the relationship between rig count and production from 1970 to present. We can see that the two parameters behave differently over time. The production though ultimately a decline, stays rather constant over time. During this same time, the rig count behaves in a much different manner. It begins with a steep increase from 1970 to 1980, then a steep decrease from 1980 to about 1986. From then on, the trend is fairly steady until 2002 when we see a steady increase through present day. Drilling success rates have steadily increased over the past 50 years (see figure 3). However, according to a study by Cambridge Energy Research Associates (CERA), which is the first ever analysis of cost data for all wells drilled in 2005, "fewer reserves are being added for every dollar of exploration and production activity, and higher costs are undermining the economics of an increasing number of wells,". The report also states that "Record well completions are being totally offset by declining per-well productivity, so price expectations will be central for motivating continued strong drilling,"[k]. Though our annual US production is steadily declining while our rig count is steadily increasing, if it were not for this increase in success rate, this between rig count and production would be much more pronounced. It seems we are drilling more wells just to keep up with previous production. "Despite a nearly threefold increase in the number of rigs deployed to drill natural gas wells over the past decade, North American gas production has remained stubbornly flat and the cost of new gas supply has risen substantially due to higher drilling and operating costs and, most significantly declining average well productivity and initial production rates." [k] In other words, the U.S. shows a solid trend of drilling lower productivity wells as more wells are drilled. The study also recognized the increased levels of drilling needed to replace gas lost from declines in production from wells drilled in the past. We have a limited production response to a high rig count. We are beginning to move to deeper gas reserves along with areas like Barnett Shale which have much steeper decline curves than their conventional predecessors. This means that the production output from these wells will drop much faster from year to year than it would on more traditional wells. Just by glancing at this chart we can see that we cannot predict one parameter from the other.

In short, petroleum production only matters because of the profit from it. To determine the profit, we must know the costs. Rig count cannot show us cost because it cannot show us depth, environment, or geology. Rig count succeeds in communicating drilling activity, modeling the petroleum job market, and predicting the demand for oilfield service. However, if we want to see production, profits, and/or costs, we need to look elsewhere. We could always find these parameters in separate places, but how can we analyze them easily and all at once? Convenience may be the reason rig counts are misused in the first place. One suggestion is a parameter that would give units of Production per rig, per dollar of cost. This would accurately portray the net profit/production for a given area or state. It would have to be nationally compiled and easy to find and use. It would give us a true look at the net productivity of the petroleum industry.

Rig count has many benefits besides ease of use, including up to date and accurate information, absence of units, and global application. We can use it easily and quickly. However, we need to acknowledge that rig count doesn't tell us the "whole story".

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