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Availability of drilling rigs as a production variable in mature onshore fields and lessons from the United States and Canada for Brazilian onshore production.

Rig availability as a production variable in mature onshore fields and the lessons from the United States and Canada for Brazilian onshore operations

Availability of platforms as a production variable in mature terrestrial fields and lecciones from the United States and Canada for the Brazilian country

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SUMMARY

Brazilian onshore oil and natural gas production reached 206,800 barrels of oil equivalent per day in 2022, the lowest level in the recent series, and the National Agency of Petroleum, Natural Gas and Biofuels projects 300,300 boe/d for 2028. This article examines which practices associated with the onshore performance of the United States and Canada can be applied to mature fields in Northeast Brazil. This is an exploratory and descriptive study, with a qualitative approach, based on documentary analysis of public data from the ANP, the US Energy Information Administration, the Canada Energy Regulator, Baker Hughes, and the Interstate Oil and Gas Compact Commission, articulated with maintenance management literature and the author's technical observation in North American and Canadian operations. The results indicate that, in 2025, approximately 74% of the oil produced in the 48 contiguous states of the United States came from wells drilled before that year, although the country operated with fewer rigs. In Brazil, where the estimated average flow rate per onshore well is around 40 boe/d, each day the well is idle awaiting intervention weighs heavily on the result. It is proposed to treat the availability of the workover fleet as a production variable and to adapt the overall equipment effectiveness indicator, derived from total productive maintenance, to the reality of onshore drilling rigs.

Keywords: mature fields, onshore, workover rigs, maintenance management, overall equipment effectiveness.

ABSTRACT

Brazilian onshore oil and natural gas production fell to 206.8 thousand barrels of oil equivalent per day in 2022, the lowest level in the recent series, and the National Agency of Petroleum, Natural Gas and Biofuels projects 300.3 thousand boe/d for 2028. This article examines which practices associated with onshore performance in the United States and Canada can be applied to mature fields in Northeastern Brazil. It is an exploratory and descriptive study with a mixed qualitative and quantitative approach, based on documentary analysis of public data from ANP, the US Energy Information Administration, the Canada Energy Regulator, Baker Hughes and the Interstate Oil and Gas Compact Commission, combined with the maintenance management literature and the author's technical observation of North American operations. The results show that in 2025 about 74% of the crude oil produced in the US Lower 48 came from wells drilled before that year, even though the country operated fewer rigs. In Brazil, where the estimated average rate per onshore well is in the order of 40 boe/d, every day a well waits for intervention and weighs on results. The article proposes treating workover fleet availability as a production variable and adapting the overall equipment effectiveness indicator, which originated in total productive maintenance, to onshore rigs.

Keywords: mature fields. onshore. workover rigs. maintenance management. overall equipment effectiveness.

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1 INTRODUCTION

The Brazilian oil industry grapples with an asymmetry that is rarely discussed outside of Brazil.
technical field. In December 2025, offshore fields accounted for 97.9% of oil.
produced in the country, while 5,501 of the 6,048 producing wells were onshore.
The distribution reveals two distinct operational worlds. On one side, the pre-salt layer, whose wells...
They produce an average of around 25,000 boe per day, as noted by Souza (2019).
On the other hand, there are thousands of low-flow onshore wells, installed in fields that have been around for decades.
operations in which production depends on frequent interventions to avoid decline.

The Northeast concentrates the largest part of this terrestrial universe. Bahia, Maranhão, Rio
Rio Grande do Norte, Sergipe, and Alagoas totaled 145,190 boe/d in December 2025.
equivalent to 58.5% of national onshore production, distributed across 268 active fields (With
advance of the pre-salt..., 2026). A large part of these assets passed from Petrobras to operators.
independent companies, including PetroReconcavo, 3R Petroleum, Origem Energia and SPE Tiêta.
(Northeast expands..., 2025). Souza (2019) draws attention to the fact that the factor of
The average recovery rate of Brazilian fields, around 24% in the Campos Basin, remains...
below the world average of 35%, and interprets recent regulatory policy as an effort
to hand these fields over to companies dedicated to extending their lifespan.

Given this scenario, this article seeks to answer a question of a practical nature.
Of the practices that support land productivity in the United States and Canada, which ones?
They can be transferred to mature Brazilian fields, but they encounter challenges.
What are the country's own geological, logistical, and market advantages? The overall goal is to identify levers
Transferable operational skills, with an emphasis on the management of the drilling rig fleet. As a specific objective,
A performance indicator for intervention probes is proposed, inspired by the literature on...
Total productive maintenance. The text presents, in addition to this introduction and methodology, six...
Development sections and final considerations.

2 METHODOLOGY

Regarding the objectives, the research is classified as exploratory and descriptive, in the terms...
Gil (2017) aims to provide greater familiarity with a problem that is still little known.
treated in national literature and, at the same time, describe characteristics of three systems
distinct productive sectors. Regarding procedures, it adopts documentary and bibliographic research.
The approach is both qualitative and quantitative, as it combines the reading of numerical indicators.

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published by regulatory bodies and companies with the interpretation of this data in light of Consolidated concepts of maintenance management and production engineering.

The documentary corpus comprises four sets of sources. For Brazil, the following were used. data from the National Agency of Petroleum, Natural Gas and Biofuels (ANP) on production onshore, number of wells and projections until 2028, in addition to regulatory acts such as Resolution ANP Resolution No. 749/2018 and documents from the Program for the Revitalization of Oil and Natural Gas Exploration and Production Activities in Onshore Areas (REATE). For the United States, Publications from the US Energy Information Administration (EIA) were used, along with counts of Baker Hughes drilling rigs and reports from the Interstate Oil and Gas Compact Commission (IOGCC) Regarding marginal wells, the Canada Energy Regulator (CER) was consulted for Canada. The corpus is completed by the operational and financial disclosures of PetroReconcavo, chosen because it maintains its own fleet of drilling and workover rigs and because it is the company in which the The author's work, and the academic literature on maintenance, reliability, and lean production.

The data processing consisted of comparing production series, number of Active wells and the composition of production between new and existing wells. When As needed, derived indicators were calculated, such as the approximate average flow rate per well. and the share of the existing base in total production, always with explicit indication of the nature of the product. approximate calculation. Three limitations are acknowledged. Recent North American geology is dominated by unconventional reservoirs, while the Brazilian Northeast operates fields Mature conventional sources. The sources utilize distinct units, such as oil barrels, barrels of oil equivalent and oil plus equivalents. Finally, some of the Brazilian figures for 2025 and

The 2028 figure corresponds to projections declared by companies to the ANP (National Agency of Petroleum, Natural Gas and Biofuels), and not to actual production.

The documentary analysis was complemented by the author's technical observation during benchmarking visits to land-based operations in the United States and Canada and by experience in the deployment of 15 completion rigs and 3 drilling rigs in Bahia and in Rio Grande do Norte. This observation did not follow a systematic collection protocol and, therefore Therefore, it is treated as an interpretative source, used to formulate hypotheses and proposals, and not as... Statistical evidence. In respect of business confidentiality, no internal data will be withheld. It was used publicly.

3. The Brazilian Onshore and the Resumption of Mature Fields

The decline in Brazilian onshore production predates the current debate by many years. revitalization. Souza (2019), based on data from ANP, notes that onshore production fell.

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approximately 30% between 2010 and 2017, a period in which most onshore oil fields already totaled more than twenty years of operation. In fields of this age, the pressure drop in the reservoir and Increased water production requires artificial lift, cleaning, and equipment replacement. of background and replenishments at a constant rate. When the capital of the same company The competition for space between these wells and very high-flow offshore projects is fueling land-based intervention. It tends to lose priority. The same author argues that, under these conditions, it was reasonable to wait. There is little appetite from major operators for investments in mature assets.

The response from the government came in layers. In January 2017, the Ministry of The Ministry of Mines and Energy launched REATE in Salvador, a program aimed at reversing the decline of... land-based production and expand the participation of new agents in the segment (Bahia, 2017). The The program's working group published a diagnosis in September of the same year with Action plans for government policies, regulation and financing (Brazil, 2017). In In 2018, ANP Resolution No. 749 allowed for the reduction of royalties to as low as 5% of the... incremental production from mature fields, contingent upon revision of the plan. development and applied only to the additional volume actually produced (Agency National Institute of Petroleum, Natural Gas and Biofuels, 2018). Souza (2019) adds that the ANP has begun to allow the use of reserves as collateral for financing, a modality known as such as reserve-based lending.

The effect of these measures is evident in the recent trajectory. Onshore production reached... The minimum of 206,790 boe/d in 2022 rose to 232,330 boe/d in 2024, according to data

Based on data submitted by companies to the ANP (National Agency of Petroleum, Natural Gas and Biofuels), production is expected to reach 242,280 boe/d in 2025 and 300,270 boe/d in 2025.

In 2028, growth of 29% over 2024 (Brazilian production..., 2025). The agency itself The reversal is attributed to a combination of regulatory incentives and the entry of new operators. after Petrobras' divestment. Aviz (2025) observes that, if this pace is maintained, production It would return to a level close to that of 2016, when it totaled approximately 298,900 boe/d. (Chart) 1 summarizes this curve, separating the realized values from the projections.

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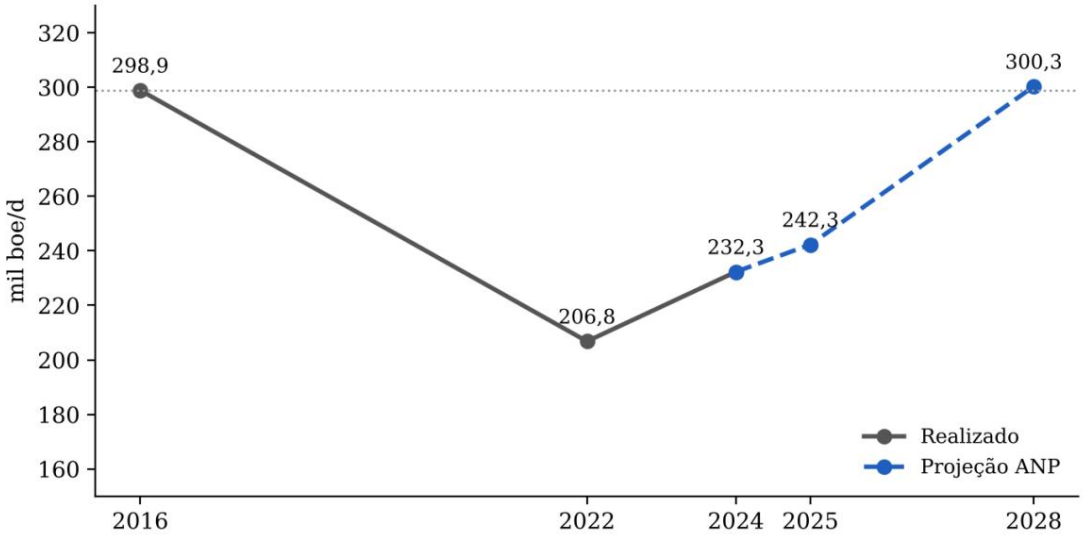
Chart 1 - Onshore oil and natural gas production in Brazil, realized and projected values

(thousand boe/d)



Source: prepared by the author with data from ANP published in Brazilian Production (2025) and Aviz (2025).

The current structure of onshore operations helps to explain why operational management is such a significant factor. The Northeast region has approximately 2,300 onshore wells in production, of which approximately 1,050 in Bahia, and in November 2025 Rio Grande do Norte produced 29,900 barrels of oil per day, compared to 20,100 barrels in Bahia (With 2,300 wells..., 2026). Production is pulverized. Canto do Amaro, one of the best-known fields in Rio Grande do Norte, delivered 5,000 boe/d in December 2025, only 2.0% of national onshore production, and Carmópolis, in Sergipe, the fifth largest onshore field in the country, delivered 8,000 boe/d, or 3.2%. of the total (With the advancement of pre-salt..., 2026). No single asset defines the result of segment, which depends on the combined performance of thousands of wells.

The interpretation proposed here is that the V-shaped curve in Graph 1 says less about the reservoir. ...and more on the intensity of intervention. The fields that started growing again after 2022. They are, to a large extent, the same ones that were declining before, with known geology and The infrastructure was already in place. What changed was the willingness of the new operators to execute it. Workovers, drilling development wells, and maintaining equipment in operational condition. If this hypothesis is correct, the availability of probes and teams will then function as The main constraint of the system, in the sense that production engineering attributes to the bottleneck of

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a line. It is within this framework that the following sections examine the North American experiences. American and Canadian.

4 United States, More Production with Fewer Rigs

The United States produced an average of 13.6 million barrels of oil in 2025. Crude oil per day, a historic record and up 3% from the previous year (US Energy) (Information Administration, 2026). The data is noteworthy because of the context in which it was obtained. According to the same source, the average number of active probes per month in the 48 contiguous states It was 5% lower than in 2024, and the number of wells drilled fell by 1%, a trend that... The agency links the drop in the price of WTI from $77 to $65 per barrel. The count Baker Hughes' weekly report confirms the trend, with 546 active rigs in the country at the end of [year]. December 2025, compared to 589 a year earlier (Baker Hughes, 2025). Producing more with less. Equipment is only viable when each unit delivers more per hour operated.

The composition of production is the most relevant piece of data for the argument presented in this article. EIA breaks down the 2025 volume into two parts: that of wells that have become operational. that year, responsible for 2.9 million barrels per day, and the number of wells drilled previously, which accounted for 8.3 million barrels per day (US Energy Information Administration, 2026). In relative terms, approximately 74% of the production of the 48 states contiguous came from the already existing base. Even in the country that has become a symbol of drilling. In intensive production, the volume is mainly sustained by old wells, whose production depends on... Monitoring, maintenance of lifting equipment, and timely interventions. A New drilling, although visible, represents a smaller portion of the annual result.

Geographic concentration reinforces the importance of equipment efficiency. The Permian region, between West Texas and southeastern New Mexico, accounted for 48% of US oil production in 2025 grew by 280,000 barrels per day, reaching 6.6 million barrels. barrels per day (US Energy Information Administration, 2026). In a previous analysis, the company itself EIA attributed the region's productivity gains to longer side trees and spacing. Optimized between wells and more elaborate fracturing projects (EIA..., 2024). These are techniques specific to unconventional reservoirs, with no direct correspondence in the fields mature rivers from the Recôncavo or Potiguar Basin. What is transferred is not the completion technique, and yes, the discipline of measuring and continuously improving the performance of each probe and each pit.

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Academic literature helps to qualify this reading. Kleinberg et al. (2018), to
Studies of the tight oil market dynamics have shown that North American production
It continued to grow even when prices fell below equilibrium points.
estimated by analysts in 2014 and 2015. The authors attribute part of this behavior to
availability of specialized equipment built in previous years for gas
shale and the slower decline in field-level production, supported by a large
number of older wells. They also show that, as the price falls, the criterion
The relevant economic factor shifts from the cost of the complete cycle to the cost of extraction, which moves...
The focus of the decision is on the efficiency of current operations.

For Brazilian onshore companies, the practical consequence is a reduction in the number of drilling rigs needed.
as a primary measure of activity. A larger fleet with low availability can deliver
fewer completed interventions than a smaller, well-maintained fleet, and what the well perceives is the
Time until intervention, not the size of the equipment park. The North American experience-
The American company suggests three more informative indicators, which are the effective operating time of
for each probe, the volume of production restored by intervention and the average waiting time.
of the inactive wells. In mature fields, where the existing base accounts for practically all
In terms of production, these indicators directly measure the operator's ability to protect the
volume that it already has.

5. Canada and Growth on an Existing Base

Canada ended 2025 with an average production of 5.35 million barrels per day.
oil and equivalents, surpassing the record of 5.14 million registered in 2024 (Canada).
Energy Regulator, 2026). According to the federal regulator, the country sets a new record at
every year since 2020, with Alberta accounting for 83.8% of the national volume. The province
It added 182,000 barrels per day in 2025, a 4% increase, driven by unrefined bitumen.
while Newfoundland and Labrador grew by about 30,000 barrels per day. Unlike
Unlike the North American case, the Canadian expansion is not supported by a wave of drilling.
horizontal, and rather in increasing the production of large-scale operations already in place, especially
in the tar sands.

This growth pattern has an important external condition. Canada Energy
Regulator (2026) links the recent progress to the start of operations of the pipeline expansion.
Trans Mountain, in May 2024, which opened additional outflow capacity from
western part of the country. Production in 2025 grew precisely to occupy that space. The lesson has been learned.

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Reaching beyond Canadian geography. In mature production systems, the additional volume
It tends to arise from making better use of existing facilities and removing restrictions.
logistics, and less so large new projects. The infrastructure for outflow and of
Processing becomes part of the production problem, and not an external element to it.

The Canadian fleet of drilling rigs exhibits a characteristic that is of direct interest to management.
Regarding maintenance, seasonality is a factor. In the week ending January 23, 2026, there were 231
active drilling rigs in the country. By May 2025, the count had fallen to 114 units, and by the end
As of December 2025, it was at 101, still seven more than a year earlier (Baker Hughes,
2025). The activity is concentrated in winter, when the frozen ground allows traffic of
Heavy equipment, and retreats during the spring thaw, when load restrictions on roads
They limit movement. A fleet that varies by more than 50% throughout the year needs a
A strict schedule to concentrate inspections and renovations during periods of low demand.

Brazilian onshore waterways are not experiencing snow, but they are dealing with predictable restrictions that...
They can be treated with the same logic. In some producing regions, rainy periods
They affect unpaved access roads and scheduled shutdowns of surface installations.
temporarily halting production at groups of wells. In December 2025, by
For example, PetroReconcavo's production fell 0.7% compared to November, mainly
due to a scheduled maintenance shutdown at the Potiguar Asset (Simões, 2026).
Synchronizing heavy maintenance of the rigs with these windows, instead of treating it as a separate event,
reduces the total unproductive hours of the system. It's the same rationale as
It guides the planning of shutdowns in the process industry.

The parallel with drainage infrastructure also applies to the Northeast. In
In January 2025, a scheduled three-day shutdown affected the flow of produced gas.
by PetroReconcavo (PetroReconcavo, 2025a), and, in the disclosure of the 2025 results, the
The company highlighted the acquisition of 50% of Brava Energia's midstream assets in Rio.
Rio Grande do Norte, including the Guamaré natural gas processing unit (Profit of
PetroReconcavo..., 2026). Movements of this type indicate that independent operators
They began to see controlling the flow of goods as a condition for protecting production, to
similar to what happened in Canada on a much larger scale. For asset management, the
The consequence is to broaden the scope of integrity, which is no longer limited to the drilling rig and the well;
It now encompasses the entire supply chain that takes oil and gas to the point of sale.

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6. Marginal Wells and the Economics of Low Flow

The United States has maintained its own statistical category for wells for decades.
Low production. The Interstate Oil and Gas Compact Commission (IOGCC), an association that brings together
State oil and gas regulators classify as marginal, or stripper, any well that...
It produces up to 10 barrels of oil per day or up to 60,000 cubic feet of gas per day (Watching
(government..., 2016). The definition is not merely technical. Marginal oil is described as
that produced by wells operating at the lower limit of profitability (Nebraska, [2014?]),
which means that small variations in cost, price, or downtime determine whether the well
It continues producing or is abandoned. This economic frontier is precisely the territory in
That maintenance management makes a bigger difference.

The numbers show the collective weight of these wells. In 2012, there were 409,593 wells.
The country's marginal oil fields produced more than 268.7 million barrels, equivalent to
17.2% of all US oil that year (Nebraska, [2014?]), which corresponds
at an approximate average of 1.8 barrels per day per well. The 2015 IOGCC report indicated
that 72.2% of the wells in operation in the country were marginal and that, in ten years, this category
It had produced 2.85 billion barrels of oil and 19.9 billion cubic feet of gas.
(Watching government..., 2016). The same document estimated that the elimination of these wells
In 2015, this would have directly caused the loss of 57,560 jobs in the states surveyed.

Brazilian onshore operations are on a larger scale than marginal wells in the United States.
but on a much smaller scale than maritime production. Dividing the projection of
242,280 boe/d for 2025 from 5,501 onshore wells in production in December of that year.
Annually, production reaches approximately 44 boe/d per well, a figure that includes natural gas and combines...
projection with point count. At PetroReconcavo, the average production of 26,500 boe/d in
2025, distributed across more than 700 wells, results in less than 38 boe/d per well (Profit of
PetroReconcavo..., 2026). The comparison with the approximately 25,000 boe/d per well in the pre-salt layer.
cited by Souza (2019) indicates a difference of more than five hundred times between the two
realities.

At this scale, the economics of the well are governed by the cost of extraction and the time involved.
productive. In the first quarter of 2025, PetroReconcavo's lifting cost was US$13.93
per boe, a 4% reduction compared to the previous quarter (PetroReconcavo, 2025b). Kleinberg
et al. (2018) show that, in low price scenarios, the decision to keep a well producing
It then becomes essentially dependent on this type of cost. For example, a well with a yield of 40 boe/d
Waiting ten days for a probe means ceasing to produce 400 boe, while a significant portion of

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Fixed field costs continue to accrue. Multiplied by dozens of wells in a row, the time
Waiting translates into a loss of production comparable to that of a new, undrilled well.

The American experience also highlights the risk of premature abandonment.
State records distinguish between temporarily stopped wells, capped wells, and...
abandoned and orphaned wells, whose owners have become insolvent or cannot be
located (Nebraska, [2014?]). A well that remains idle for a long time tends to
It requires more expensive intervention to resume production and is nearing the decision to abandon the project.
It is therefore proposed that the queue of interventions be prioritized by the production restored by
The day of the probe, and not just based on the order in which requests are received or on convenience.
Logistics. This criterion converts the availability of the probe into volume and makes the cost explicit.
for each day the equipment is out of service.

7. Asset Integrity and Regulatory Standardization in Drilling Rigs

Brazilian maintenance literature offers a definition that fits well with
The problem of terrestrial probes. Kardec and Nascif (2009) understand that the mission of maintenance
It is to ensure the availability of the equipment and facilities to meet the process requirements.
Productive, reliable, safe, environmentally friendly, and cost-effective. A
The formulation shifts the focus from repair to availability, which is precisely the variable.
defended in this article as a determinant of production in mature fields. Moubray (1997),
In systematizing reliability-centered maintenance, it follows a similar line of thought when proposing
that maintenance strategies be defined based on the function that the asset must preserve.
and the consequences of each failure mode, not the failure considered in isolation.

Garg and Deshmukh (2006), in a broad review of the literature on maintenance management,
They organize the field into large groups of issues, including optimization models and techniques.
maintenance, programming and information systems, and identify a change of
A paradigm shift towards more integrated business approaches. Applied to a fleet of drilling rigs.
In the context of workovers, this classification helps to separate problems that are usually treated as one.
That's all. The choice between time-based preventive maintenance and condition-based maintenance is a...
It's a technical matter. Deciding when to remove a probe from operation without compromising the queue of...
Well management is a matter of scheduling. Knowing how much production each day of downtime cost requires...
An information system that integrates maintenance and production data.

From a technical standpoint, the international benchmark for drilling rig structures is the practice...
The recommended API RP 4G, whose fifth edition, from 2019, establishes operating procedures,

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inspection, maintenance and repair of masts, towers, substructures and accessories of drilling rigs Drilling and well intervention (American Petroleum Institute, 2019). The document is... It serves as a complement to manufacturers' instructions and safety recommendations. from the API 54 standard, which indicates the layering logic adopted by the industry. The mast is the component whose failure has the most serious consequences in a workover probe, both for the safety of the teams as well as for downtime, and that's why it's central. within the scope of this recommended practice.

In Brazil, the legal safety framework is provided by the Regulatory Standards. NR-12, as amended by SEPRT Ordinance No. 916 of July 30, 2019, applies. new and used machinery and equipment and determines that its application takes into account the machine characteristics, process, risk assessment and state of the art (Brazil, 2019). In the deployment of the 18 probes conducted by the author in Bahia and Rio Grande do Norte, These two layers were combined into integrity verification checklists of the type... MODUSPEC, applied before each piece of equipment enters operation. Standardization It reduced variability between units, simplified team formation, and made failures... Comparability between probes is a necessary condition for analyzing causes.

However, there are limits to transferring the American model in this field. The market for land drilling rig services and parts in Brazil is much smaller than that of the United States. United States, and imported items may have replacement lead times that make a simple defect seem like a serious problem. During weeks of downtime, PetroReconcavo presents the vertical integration of drilling rigs. and services as a source of lower costs and greater efficiencies (PetroReconcavo, 2024), This strategy can be interpreted as a response to this market constraint. For the management of Integrity, the consequence is the need for a critical spare parts policy. determined by the replacement lead time and the impact of the failure on production, and not just by unit cost of the part.

8 FROM THE ASSEMBLY LINE TO THE PROBE

The automotive industry has faced a structurally similar problem for decades. with that of probes in mature fields. Ohno (1988) described the Toyota production system. as a systematic search for the elimination of waste, supported by just-in-time and by automation, and Womack, Jones and Roos (1990) popularized the concept of lean production. Based on a comparative study of the global automotive industry. In assembly lines. with sequential supply, like those that supply automakers with complete seats.

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In the exact order of vehicle production, a stopped station interrupts delivery to the customer.
in a matter of minutes. In this environment, equipment availability is treated as
production variable from the origin.

It was in this context that Nakajima (1988) structured total productive maintenance and the
Overall Equipment Effectiveness (OEE) is an indicator of overall equipment effectiveness, calculated by the product of
Availability, performance, and quality. The author associates the indicator with six major losses.
which are breakdowns, losses due to setup and adjustment, minor stoppages and downtime, the
Reduced speed, defects and rework, and starting losses. The strength of OEE lies in
consolidate losses that typically belong to different areas of the company into a single number.
Maintenance is responsible for breakdowns, planning for delays, and operations for downtime.
Quality is important, but the equipment only delivers results when all three dimensions are working together.
same time.

The application of OEE outside of its original context is a well-established topic in the literature.
Muchiri and Pintelon (2008), in a review published in the International Journal of Production
Research shows how the indicator gave rise to variations such as TEEP, PEE, OFE, OPE and
OAE discusses the differences between theory and practice in two industrial cases and proposes a
A framework for classifying and measuring production losses, adjustable to the needs of each company.
The authors' conclusion justifies adapting the indicator to assets that are not machines.
assembly line, provided that the definitions of each loss are consistent with operational reality. It is this methodological
openness that allows the concept to be taken to the fleet of drilling rigs.

It is therefore proposed that the OEE be adapted to intervention probes, as expressed by
Equation (1).

$$OEEsonda = D \times P \times Q \quad (1)$$

In this formulation, D represents availability, given by the ratio between the hours in
that the probe was ready to operate and the planned operating hours during the period. P represents performance.
given by the ratio between the standard time of completed interventions and the time actually taken.
operated, similarly to Nakajima's (1988) performance rate. Q represents quality,
measured by the fraction of interventions that did not require a return to the same well within a given timeframe.
defined by the operator. Accompanied by the mean time between failures and the mean time of
Repair, the indicator allows distinguishing losses due to equipment failure, losses due to
planning and losses due to intervention quality. This is a conceptual proposal, whose
Validation depends on internal operational series.

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A second contribution from manufacturing comes from Shingo's (1985) work on the Quick tool change, the SMED system, whose central idea is to convert activities of Internal setup, performed with the machine stopped, in external setup, performed with the The machine is in operation. Onshore, the equivalent of preparation is the sequence of dismantling, transporting and reassembling the drilling rig between one well and another, a period during which the The equipment does not intervene in any well. Prepare the next location, pre-position. Materials and completing document verifications before the probe arrives are ways to... to externalize this preparation. In the author's experience, who worked in the implementation of lines Automotive wells, before reaching the oil wells, are located in this interval between wells. Faster availability gains and less dependence on investment.

CONCLUSION

This article started from the question of which practices are associated with land performance. Analysis from the United States and Canada could be applied to mature Brazilian fields. Public data and literature indicate that the most relevant contribution of the North American experience... American practices are not present in the drilling and completion techniques developed for reservoirs. unconventional. It lies in the way the existing well base is managed and in the discipline of measuring. the performance of each piece of equipment, aspects that do not depend on geology and can be incorporated into the routine of Brazilian operators.

In Brazil, onshore production followed a V-shaped trajectory, with a low in 2022 and Projected return to 2016 levels by 2028. Public policies initiated with REATE. and the reduction of royalties on incremental production created the economic conditions for This recovery, and the transfer of assets to independent operators, brought agents willing to invest in fields that had lost priority. Regulation, however, defines Only the space of possibilities. The volume actually delivered depends on capacity. operational aspects for those in the field.

The case of the United States shows that it is possible to produce more with fewer probes. In 2025, the country broke a production record with fewer active rigs and fewer wells. drilled, and about three-quarters of the volume of the 48 contiguous states came from wells drilled in previous years. For mature fields, in which virtually all production This comes from the existing base; this finding reinforces that the relevant measure of activity is not the It's not the size of the fleet, but rather the number of well-executed interventions per unit of time.

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Canada, in turn, grew by leveraging existing facilities and relocating
There are bottlenecks in the flow of goods, in addition to operating with a highly seasonal fleet of drilling rigs. Of these
These characteristics provide two lessons for the Brazilian Northeast. The first is to align the
Heavy maintenance of the rigs during predictable periods of lower demand, such as shutdowns.
scheduled surface installations. The second is to broaden the concept of integrity to
include the drainage and processing infrastructure, which is already being incorporated by
independent operators.

The comparison with marginal wells in the United States highlights its unique economics.
due to low flow rates. With an estimated average production of around 40 boe/d per well, the onshore
Brazilians operate in a range where the cost of extraction and production time determine the...
viability of each asset. In this context, prioritization of the intervention queue by production.
Restored per day of catheterization emerges as a simple and high-impact criterion, capable of reducing
losses and to prevent wells that have been idle for too long from becoming abandoned.

In the field of asset integrity, the definition of maintenance centered on
The availability of the function provides a solid conceptual basis for the argument. The combination between
The recommended practice API RP 4G and NR-12, translated into standardized checklists of
verification proved to be a viable way to reduce variability between probes and make the
Comparable failures. The restricted market for parts and services in Brazil, on the other hand, requires
critical spare parts policy driven by lead time and the impact of failure on
production.

The main proposed contribution of the study is the adaptation of the effectiveness indicator.
global equipment for intervention probes, accompanied by the application of the principles of
Quick exchange at the interval between wells. Both proposals transport to onshore.
Consolidated tools in the automotive industry, where the availability of equipment
It has always been treated as a production variable. The convergence between the two sectors suggests that
Managing drilling rigs in mature fields has more in common with managing a pipeline.
assembly of what is usually recognized.

The study presents limitations that pave the way for future research.
International comparisons involve distinct geologies, units, and scales; part of the data
The data from Brazilians corresponds to projections, and field observation did not follow a systematic protocol.
It is recommended to test the proposed indicator with operational series from different operators and
To statistically investigate the relationship between probe availability and production. If the hypothesis

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If confirmed, the recovery of Brazilian onshore oil exploration will depend less on new discoveries and more on the future.

the quality with which the equipment that keeps existing wells producing is managed.

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