2020

ELC Case Competition

WELL-OILED MACHINE

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I. Executive Summary

Overview

This report was written with the intent to advise Super Oil & Gas (SOGC) on how they can take the next step in the digitalization of their business and become an industry leader within Oil & Gas.

The Problem

Super Oil & Gas has successfully the first stages of a complete digitalization but isn't sure how they can leverage Artificial Intelligence (AI) and automation within their industry to drive top and bottom line financial improvements. Furthermore, one of the key issues within the industry is the lack of diverse and underrepresented employees. This makes digitalization of their business even more susceptible to failure due to a lack of talent available to fill the new technical positions.

The Solution

SOGC will need to focus simultaneously on three work streams if they want to be successful: (a) the creation of a planning and strategy development team, (b) the technical digital transformation operations, and (c) a well-planned hiring and retention plan for employees across all levels. In general, all operations need to be headed by leadership at the executive level and have the full sponsorship of SOGC.

Keys to Success

- Fully commit to 100% digitization
- A full audit of current practices
- The hiring of a Chief Digital Officer
- Revamp hiring and retention tactics, target underrepresented minorities.

II. Company

Super Oil and Gas Corporation (SOGC) is a global corporation with approximate revenues of $180 billion. In the United States (US), SOGC has an estimated workforce of 27,000 employees. In the past, the company has made steps towards digitalization, which has led to increased productivity, safer operations and significant cost savings. [1]However, SOGC has concluded that more steps are necessary to become a true digital leader.

Looking towards the future, Super Oil and Gas Corporation is seeking to "modernize their business infrastructure, which includes utilizing more automation and artificial intelligence." [2]As the company continues the shift towards digitalization, leadership aims to ensure effective recruitment and retainment of underrepresented groups. Key questions being asked by leadership are noted below.

- How does digitalization improve a company's financial performance and what impact does digitalization have on innovation, creativity, and inclusiveness?
- How can recruitment and development of diverse and underrepresented groups support digital strategy initiatives in the oil and gas industry?[3]

The following report provides solutions to the above-mentioned questions.

III. Industry Landscape

a. Oil and Gas

The oil and gas industry consists of three main sectors: upstream, midstream and downstream. The upstream sector focuses on exploration and production, while the midstream sector involves shipping and storing. The downstream sector concentrates on refining, processing, transportation, distribution, and marketing to consumers. [4]

Within the upstream sector, exploration begins with geological surveys and/or seismic surveys to locate petroleum reservoirs. After locating the reservoirs via the survey methods previously mentioned, exploratory wells are drilled to determine if oil and gas exist in these locations. When there is a presence of oil/gas, the wells are completed. Recovery of the oil occurs using different recovery techniques: primary, secondary and tertiary recovery. Primary recovery relies on using the natural pressure differential or pumping to bring the oil to the surface. Secondary recover works using different pushing mechanisms, either in

[1] ELC National Business Case Competition – Leadership in the Digital Age
[2] Ibid.
[3] Ibid.
[4] Understanding the Basics About the Oil and Gas Industry: https://www.linkedin.com/pulse/20140610195219-160381676-understanding-the-basics-about-the-oil-and-gas-industry

the form of water or gas injection. Tertiary recovery, utilized after both primary and secondary have been fully exhausted, is defined as enhanced recovery techniques. One example is fracking, which is the process of injecting fluids under high pressure into the rock formations (shale for example). [5] The processes mentioned above are utilized throughout the upstream sector.

The midstream sector involves the storing and shipping of gas and natural gas. In the United States, this sector is highly regulated in terms of pricing and transportation of the oil and gas around the country (typically via pipelines). [6]

The downstream sector involves the refining, processing, transportation, distribution, and marketing to consumers. Essentially, "the downstream sector focuses on the last link in the industry's value chain by turning raw materials like crude oil and natural gas into high-value products such as fuels and petrochemicals." [7] The refining process involves three steps: separation, conversion, and treatment. Separation occurs when crude oil is pushed through hot furnaces, separating into liquids and vapors based on boiling points. Conversion then utilizes a combination of pressure, heat, and a catalyst to turn heavy hydrocarbon molecules into lighter ones. During treatment, the refinery combines the two hydrocarbon streams together to create a finished product. After refining occurs, marketing and distribution follows. Marketing and distribution focus on the transport and sale of products to the end users (gas stations, utilities, etc.). [8]

b. *Industry Leaders*

There are many players in the oil and gas industry, including national (United States) and global organizations. The national and global leaders within this industry are noted in the following sections.

i. *National Leaders*

At the end of 2016, oil and gas supplied approximately 66% of the energy consumed by Americans. According to the US Energy Information Administration (EIA), "natural gas and oil will account for nearly 70% of the country's energy use by 2050, while the top….companies in the USA

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[5] Understanding the Basics About the Oil and Gas Industry: https://www.linkedin.com/pulse/20140610195219-160381676-understanding-the-basics-about-the-oil-and-gas-industry

[6] What is Midstream Oil and Gas: https://ifsolutions.com/what-is-midstream-oil-and-gas-industry/

[7] An Investor's Guide to Downstream Oil and Gas: https://www.fool.com/investing/investors-guide-downstream-oil-gas-industry.aspx

[8] Ibid.

are expected to continue leading the market in the near future." [9] The oil and natural gas industry in the US will continue to grow as Americans depend on its energy resources.

The ten largest oil and gas companies in the United States are noted in Figure 1. It is important to note that the two leading companies in the US are ExxonMobil and Chevron. Both companies are strong proponents of technology and effectively utilize it to enhance business operations.

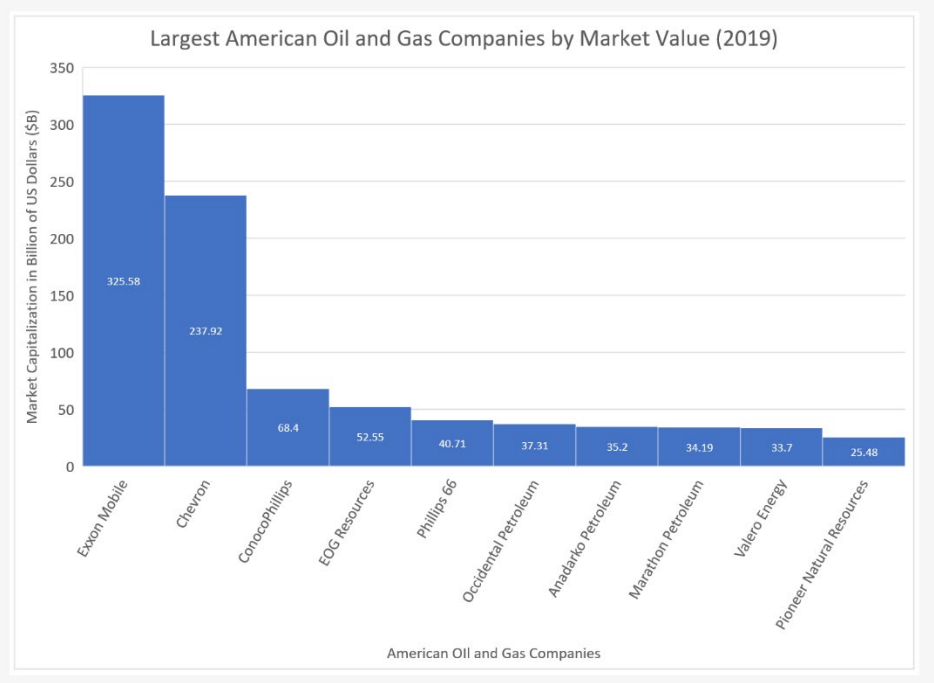

Figure 1: Largest US Oil and Gas Companies by Market Value (2019).[10]

[9]The Top 10 Largest Oil and Gas Companies in the USA: https://blog.technavio.com/blog/top-10-largest-oil-and-gas-companies-in-the-usa

[10]Top 10 US Oil and Gas Companies Based on Market Value: https://www.statista.com/statistics/241625/top-10-us-oil-and-gas-companies-based-on-market-value/

ii. Global Leaders

Top global leaders in the oil and natural gas industry are listed in Figure 2. Each company has assets in different segments of the oil and gas industry.

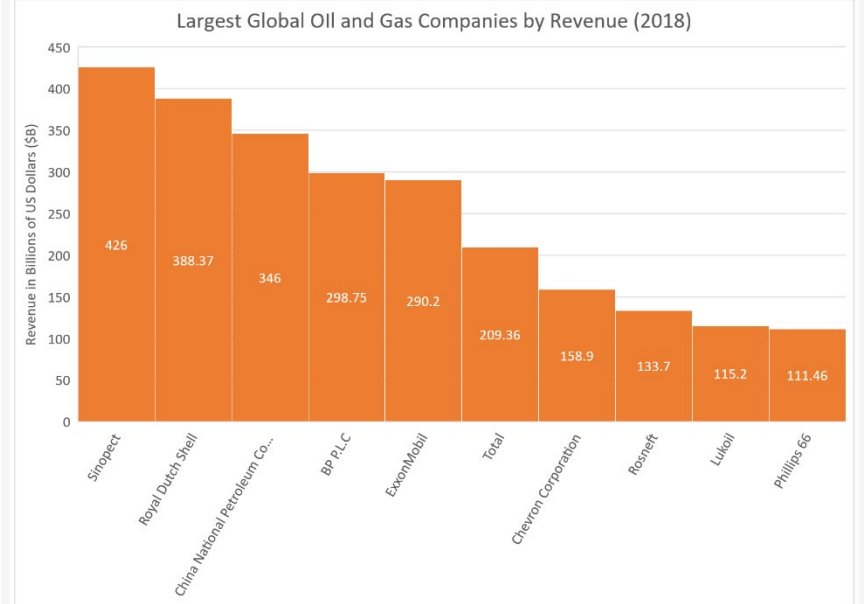

Figure 2: Largest Global Oil and Gas Companies by Revenue (2018).[11]

c. *Desire to Move Toward Digital*

The desire to pursue digitalization is extremely present within the oil and gas industry. Industry leaders see an opportunity to obtain improved operation efficiency and achieve better safety operations. [12] There is also significant talk about the cost savings derived from streamlined operations. As such, industry leaders have begun to implement various digital strategies.

IV. Opportunities for Digital Leadership in Oil and Gas

a. *Overview of Automation in Oil and Gas Industry*

Digitalization in oil and gas industry allows firms to optimize production efficiency. Specifically, the digitization of maintenance, trading, risk assessment and data collection for decision-making support enable oil and gas firms to cut costs, operate efficiently and make smarter enterprise decisions with real-time information. For example, with data analytics and predictive models, petroleum

[11] The World's Biggest Oil and Gas Companies: https://www.offshore-technology.com/features/largest-oil-and-gas-companies-in-2018/

[12] Is Digitalization in Oil and Gas Wowing the Workforce: https://www.forbes.com/sites/markvenables/2018/07/20/is-digitalization-in-oil-and-gas-wowing-the-workforce/#3f5609844a1f

companies can monitor and forecast equipment maintenance enabling them to better control output through scheduled production downtimes. This digitalization gives oil and gas companies better control of the upstream process.[13] According to a study conducted by IBM, oil and gas companies need to undergo a "digital reinvention," where the enterprise-customer relationship is reconstructed through the combination of digital technologies such as cloud computing, internet of things and data analytics. In 2017, 55% of 300 surveyed chemicals and petroleum executives reported that the boundaries between their industry and others were becoming blurred, citing that "traditional [petroleum] value chains are being fragmented and replaced"[14] by the efficiencies gained by technology contracts or capital investments.

To best facilitate a digital reinvention, the firm must first realize that the industry now operates in a Everyone-to-Everyone (E2E) economy, where consumers demand more customized experiences and products from petroleum suppliers. According to IBM, E2E "*is orchestrated, based on business ecosystems that are both collaborative and seamless. It is contextual, in that customer and partner experiences are calibrated and relevant to their specific actions and needs. It is symbiotic, in that everyone and everything, including customers and businesses, are mutually interdependent. And it is cognitive, characterized by data- enabled, self-supported learning and predictive capabilities.*" [15] (see Figure 3).

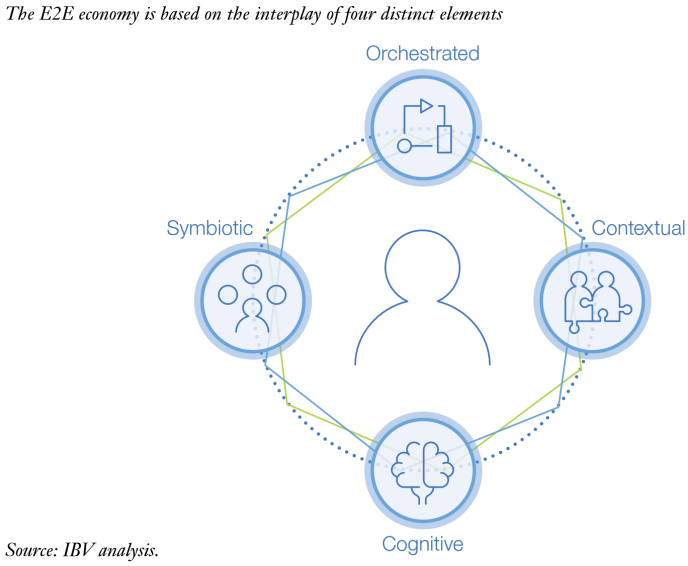

Figure 3: Everyone-to-Everyone (E2E) economy

The digital reinvention allows oil and gas firms to facilitate and leverage innovative solutions, drive efficiencies and cut costs in operational activities to ultimately enhance the company's revenue streams. Engaging stakeholders

[13] Extracting Digital Rewards: Digital Reinvention in petroleum: ttps://www.ibm.com/downloads/cas/OWVRL534
[14] Ibid.
[15] Ibid.

(retailers, logistical companies, refineries, etc.) allow oil and gas companies to pinpoint the needs and mitigate friction points in the production cycle. IBM found that the companies who were successful at integrating technology and implementing automation processes improved equipment productivity, monitored and remediated health, safety and environmental risks, found new sources of energy, controlled costs and several measures and had 131% greater efficiency than their peers. As SOGC moves to digitize its processes, leadership should learn from the companies who successfully implemented technological advances across the industry to stay competitive.

b. Reasons to Digitize Business Infrastructure

Recent digitalization in the oil and gas sector has focused primarily on data digitization. Sensors have been incorporated to valves and pipes for different measurements and this data is accessible digitally by the different personnel for manual analysis/decision making. The next frontier, which hasn't been widely implemented, to achieve digital leadership is being able to effectively automate most of these analyses and decision-making points using AI as the main driver. This automation would reduce the number of human errors during analysis and decision-making and reduce overall bottlenecks. Automating these different processes can yield tremendous benefits. Some potential benefits are listed below.

Improved Production Efficiency

- *Seismic Interpretation:* The process of finding faults and horizons is very human-intensive and knowledge-intensive. Seismic interpretation has been likened to radiology in medicine because the geologist or technician must sift through thousands of images.[16] In contrast, radiology has incorporated AI & machine learning for clinical decision support. This has improved the workflow of radiologists and enhanced precision. Incorporating AI in seismic interpretation would most likely yield similar results allowing for more accurate swifter seismic interpretation.

- *Well Capacity Estimation*: Wells differ in their geology properties, such as thickness, thermal maturity, or gamma ray levels. With available data of different wells and automated AI systems, the production capacity of each well can be estimated more accurately. AI may be used to determine which parameters really affect well outputs and base estimations upon those parameters.

[16] Artificial Intelligence and Seismic Interpretation. https://www.geoexpro.com/articles/2019/05/artificial-intelligence-and-seismic-interpretation

- *Smart Drilling*: Geosteering and other "smart drills" can mitigate the risks and increase the upside of onshore and offshore drilling. AI powered drills can use data, such as, vibration, thermal gradients, and so on to automate the speed and direction of drilling. Oil drilling is a precise operation that, if done incorrectly, can lead to high risk accidents, oil spills, downtime and fires. Improving the precision of this operation by using smart drills that can control their rate of penetration based on the data they are actively collecting can exponentially reduce the uncertainties involved – like changes in temperature that could damage the drill at lower depths, or shifting land mass beneath the earth surface. [17]

- *Predictive Maintenance*: Maintenance scheduling of oil and gas assets is resource intensive. This process can be optimized by using sensors that relay maintenance information to the personnel. By doing so, maintenance resources can be allocated to assets with immediate need until the sensor data indicate otherwise.[18] AI can also learn from this data to determine the maintenance schedule or timeline of different assets based on past data. This AI program can also provide recommendations for fixes of faulty components based on past data. Oil and gas assets sometimes stay idle until market conditions are favorable to operate/drill. Using sensors to track those assets and automating the alert process to required personnel when the market conditions become favorable can help to reduce downtime and increase production efficiency.

Better Data Digitization

- *Predictive Data Analysis:* Though data is collected at the different points in the production value chain, each segment is siloed, and the data is not collected, transmitted, stored, interpreted, visualized and used effectively.[19] Automation and AI will allow the collection of millions of data at different points, the storage of the data in a dynamic environment, transmission of the data to an AI-enabled visualization tool where key decision makers can utilize enhanced machine learning to make informed decisions. For example, if the sensor for a component in TX sets off an alarm, the maintenance team can

[17] AI is transforming the oil and gas industry. Here's how. https://www.allerin.com/blog/ai-is-transforming-the-oil-and-gas-industry-heres-how
[18] Predictive Maintenance for Upstream Oil and Gas. https://blogs.oracle.com/datascience/predictive-maintenance-for-upstream-oil-and-gas

[19] Digitizing oil and gas production. https://www.mckinsey.com/industries/oil-and-gas/our-insights/digitizing-oil-and-gas-production

visualize the service history of that particular asset and recommendations on how to fix it from data collected from similar assets owned by the company

Improved Worker Safety and Communication

- *Automated Shutoff*: Sensors and AI programs can be automated to shutoff rigs, pipelines or production operations when there is a critical glitch – like a leakage or faulty component. This will decrease human error as sensors report malfunctions and/or shutdown assets in critical cases, as oppose to relying on a manual shutoff. The sensors will also allow maintenance personnel to identify exactly what and where the issue occurred, while AI will use past data from the different rigs to come up with recommendations on how to fix the issue. This automated shutoff will prevent operations in unfavorable situations and can also eliminate the need for personnel who would have had to go shutoff the rig/valve/pipeline in dangerous conditions. [20]

- *Push Communication to wearables*. Push messages can be sent directly to the wearables of the rig personnel so that they are informed about any critical situation. This will allow seamless communication across rigs that span hundreds of thousands of square feet, ensuring all personnel on the rigs are getting real-time information that will allow them to react in a timely manner to prevent any injuries and/or deaths. Wearables are also more portable than the current walkie-talkies.[21]

- *Drone-Powered Rig Inspections*. Rig personnel are required to perform regular inspections of the rig, some of which are as high as 40-storeys. This makes this task dangerous, and the fact that it is done by different personnel means there is also some inconsistency in how the data is collected and the final data output. Using automated drones for rig inspections can mitigate some of these risks while improving the data quality and accuracy. The pictures and videos can be streamed and stored directly to the cloud accessible to from any location. As the automated drone does more inspections, AI programs can be used to optimize flight patterns, the data collection process, real-time data analysis, and maintenance recommendations. [22]

[20] Digitizing the future oil field. https://www.pwc.com/us/en/industries/assets/pwc-eu-m-web-graphics-midtream-digital.pdf
[21] Ibid.
[22] Ibid.

Reduced Environmental Impact

- *Spillage/Pollution Detection*: Since digitalization is a holistic process, improvements in one area inevitably improves other areas too. The implementation of smart drilling and maintenance will reduce the number and frequency of accidents that may lead to oil spills that end up polluting the Earth. Also, incorporating sensors that automatically report changes in PVT (pressure, volume and temperature) measurements in pipelines to the required personnel, as well as, the location in the pipeline where this "drastic" change may have occurred will help field personnel catch leaks in pipelines faster and fix it faster.

- *Methane Leak Detection*: The combination of drone inspections, optical sensors and AI can also be used for methane detection. Algorithms can be written for the drone to keep a consistent flight path while improving on this flight path, and data collection process using AI. The data collected can be automatically analyzed using AI programs and visualized on portable devices by the safety personnel. The more the drone collects and detects possible methane leaks, the better the drone gets at detection, making the process more accurate and quicker as time progresses.

i. *Limitations of Current Digitization Practices*

As this legacy industry continues to make the dramatic digital transformation, oil and gas companies face several limitations in digital implementation. A study of the digitization of oil and gas companies conducted by McKinsey and Co. consultancy found four key requirements for effective automation of the upstream maintenance operations of oil and gas companies. Though four key points were highlighted as potential limitations to full digitalization in upstream activities, the requirements can also be applied to the downstream value chain.

1. Data Capture: Hardware sensors on equipment are used to automate the collection of equipment maintenance status. This data collection affords upstream firms the opportunity to forecast maintenance downtime in their production cycles. To aid this automated data system, engineers are still required for capturing and measuring performance data for assets not yet equipped for automation, and to conduct inspections and failure analysis on all assets. This stresses the need for adaptable

engineers that can both digitally and manually collect, aggregate and use data to inform production decisions.

2. Data Infrastructure: The combined data capture between the hardware sensors and engineers emphasizes the need for a system infrastructure that integrates the hardware's technology with the engineer's expertise. The infrastructure will facilitate information flow to support decision-making processes at the management level.

3. Data Analytics: To further enhance production efficiency and to optimize balance between upstream and downstream activities, analysis of data from the end-to-end value chain is required for success. This level of data analysis will move an oil and gas firm to the next level by "adapting upstream production levels to account for expected future demand shifts in downstream retail"

4. Staff Training and Data Visualization: With the digitization of the process, comes a need to ensure all users of the data have a working knowledge of the software applications to present data that is collected through automation. This potential information gap will create gaps in decision-making support at all levels.

ii. Impact on Legacy Assets/Decisions/Processes/Structures

Oil and gas companies are facing an aging workforce leading to a loss of knowledge as individuals retire. This is leaving legacy assets behind without the added benefit of worker experience and knowledge. Digitalization would revive and prolong the lives of these legacy assets. This wealth of knowledge can now be digitalized and, centralized and made available to anybody in the organization. This allows for continuity as the workforce evolves overtime.

In addition, digitalization, e.g. smart maintenance, can help prolong the lives of legacy assets. Oil and gas companies can use data from different assets to determine which components in a rig are liable to fail and replace them or update their inventory before these components fail.

Digitalization also allows for digital twinning – a virtual replication of the legacy asset – which allows maintenance personnel to virtually plan and/or simulate modifications. This will reduce downtime and allow for more

frequent maintenance which will help prolong the lifespan on these legacy assets.

iii. Potential Roadblocks/Issues

Most oil and gas companies that have implemented digitalization have fallen short because they haven't committed 100% to digitalization. The companies have implemented digitalization in only some aspects of their operations, e.g. using sensors to measure for PVT analysis, but the analysis of this data still must be done manually. Thus, making digitalization another bottleneck instead of an innovative solution. Some of the reasons behind this lack of commitment are noted below.

- *Operational Disruption*: For digitalization to be successful, it has to be an end-to-end process i.e. the current operational process has to change, and in some cases, have to halt until digitalization is complete. This presents a unique problem, especially for brownfield assets that have already been deployed – stopping operations temporarily until the digitalization process is complete. The way to mitigate this disruption is through proper internal communication, segmented implementation, operational prioritization and using digital tools (like digital twinning) to plan the modifications beforehand to reduce the downtime.

- *Cybersecurity Risks:* Digitalization possess significant cyber security risks that can result in leakage, sabotage and data manipulation. These risks can lead to major economic losses and jeopardize lives and assets. We have already seen instances where unmanned vehicles and drones have been hacked and manipulated, so the cyber threat to digitalized assets is real. Because of this, a company's digitalization plan must include, and align with a robust cyber strategy to address most of these cyber risks.

- *Digital Skill Gap:* The workforce in most oil and gas companies currently lack the skills required to support fully digitalized operational processes. These processes now require data scientist and analysts, machine learning experts, amongst others. This means that these companies will have to change their recruitment strategies and get creative with their recruiting process, especially since they will be competing with Big Tech firm, and banks for the same talent.

- *Internal Resistance/Lack of Commitment*: The major cause of most digitalization failures is the lack of commitment from all stakeholders to successfully integrate digital tools, and processes. The digital readiness of the internal "customers" needs to be considered by the senior management, and work must be done to ensure everyone buys into the process for digitalization to be successful. It's vital for a company to establish complete alignment, both organizational and strategic, around its digital efforts, including sorting out which challenges and opportunities need to be addressed and when.

iv. Digital Adoption

Below are the different operational processes and tools, mostly digital, and what adoption stage they are in within the oil and gas industry (See Figure 4).

ADOPTION	UPSTREAM	MIDSTREAM	DOWNSTREAM	MARKETING/COMMUNICATION	HR/RECRUITING
Industry Standard (High Adoption)	Field Production Optimization Integrated Portfolio Management Reservoir Characterization Data and Workflow Integration (Analytics)	Reservoir Characterization Pipeline Risk Assessment Storage Optimization	Mobile Payments PVT Metering Reservoir Characterization	Collaborative Tools e.g. Slack, Microsoft Team and 360 Borderless workspaces Social media Videoconferencing	Job boards and referrals Virtual Interviews Mobile recruiting tools
Commercially available (Medium Adoption)	Predictive Maintenance Automated Supply Chain/Supply Chain Optimization Standardized and Modular Rig Design Artificial Lift Optimization Automated Data Interpretation Worker Management (Safety) Rig Surveillance and Inspection (Non-automated)	Digital Asset Management to detect leaks Data and Workflow Integration (Analytics)	Data and Workflow Integration (Analytics) EV Charging Stations Personalized offering using AI & Machine Learning Omnichannel strategy	AI-powered Chat Bots Cloud Infrastructure Unified information Streams, Apps & Data Dashboards Enterprise App Store Data Visualization Dashboards	Game and simulation-based recruiting Hackathon Social media and coding repository recruiting
Pilot Testing (Low/No Adoption)	Automated Drilling Digital Twin – Asset Simulation, Monitoring and Control Connected Oil Workers (Wearables) Intelligent Completion Robots for safety critical processes Automated drone surveillance and inspection	Automated drone surveillance and inspection Biometric Monitoring using Wearables Smart Trucks Automated Pipeline and Reservoir Configuration	Transparency using blockchain and smart contracts Smart Trucks Data Driven Supply Chain	Voice activated smart assistants and workspaces Telepresence Robots Biometric Monitoring using Wearables AI-powered Data Visualization Tools Employee Activation	Automated Candidate Sourcing and Re-discovery AI-powered Chat Bots Facial and Voice Recognition Virtual Interviews Predictive Analytics to candidate's success rate

Figure 4: Operational Process tools within the oil and gas industry

v. Potential Financial Performance Benefits

The structural and procedural benefits of digitalization of the oil and gas industry is readily apparent through this analysis. However, as a result of the production efficiency gained from a complete digital implementation, oil and gas firms can also enjoy significant cost reductions and increased revenues. Improving production efficiency by just 10% for an existing asset cost anywhere between $220-$260M, and significantly more any digital capabilities added to a new piece of equipment in the design stages.[23] Despite the significant costs for implementation companies who have fully embraced digitalization have enjoyed 130% increase in

[23] Digitizing Oil and Gas Production: https://www.mckinsey.com/industries/oil-and-gas/our-insights/digitizing-oil-and-gas-production

revenues (121% higher profitability) than their industry peers.[24] With SOGC currently earning $180 billion in revenue a year, they can increase revenues to over $400 billion a year.

vi. Culture Changes

One of, if not the biggest component of any company's digital strategy will be equipping its people to use today's technology and readying them for how their roles may evolve in the future. Many companies across a wide range of industries have failed in their digitization efforts because they were able to change their business but not their people. As an incumbent in Oil & Gas, SOGC has been successful up until now because of legacy systems, tools, processes, and a culture that meshed well with their business. To successfully digitize their business infrastructure and become a leader within the industry, the very culture of SOGC needs to change.

The main driver around a successful digitization will be the leadership culture within SOGC. A 2017 McKinsey study[25] shows that statistically, a company is more likely to successfully digitize their business when leaders are committed to acting. From the CEO advocating for it and sponsoring it to the proper appointing of managers who can lead the efforts across departments, everyone must buy in. The major business process changes need to be met with a culture that thrives on innovation, creativity, and inclusiveness.

1. *Leadership Culture*

   Digitization is going to change the entirety of SOGC and a lot of the old systems and tools that were pioneered by today's leaders will become obsolete. As a result of this, naturally a change and shift are expected to happen within leadership. A step that should be top of mind for most organizations undergoing digitization efforts, but commonly overlooked, is finding that digital-savvy leader to head it all. There are two main components that should define this individual and any other leader involved with this change effort:

   1. Dedicated full-time
   2. Committed and involved

[24] Extracting Digital Rewards: Digital Reinvention in petroleum: https://www.ibm.com/downloads/cas/OWVRL534
[25] What successful digital transformations have in common https://www.mckinsey.com/mgi/overview/in-the-news/what-successful-digital-transformations-have-in-common

To start, lets discuss the need for a Chief Digital Officer (CDO) and why having one can make a successful transformation. Hiring a CDO at the offset of a full-scale digitization effort will signify SOGC's intent and drive their further commitment to achieving their goals. The CDO offers five main benefits:

1. Make digitization integral to the overall SOGC strategy.
2. Understanding SOGC's customers and how digital can serve them better.
3. Create a "spirit of digital" across the entire organization.
4. Understand technology trends and how they are impacting the industry.
5. Leverage their position to get things done, fast.

History has shown that companies spend too long trying to find the perfect fit for their new CDO when instead they should focus on finding someone who has a track record of success when it comes to large-scale change. Specifically, if a candidate has been able to lead a transformation across an entire organization, they will be better equipped for this role than any technology guru. A survey of CDO's has shown that they estimate 80% of their job is people management, so it is imperative to hire a good cultural fit and a leader with high EQ. [26]

After vetting and hiring a CDO that SOGC is confident can lead the next phase of their digitization, it is recommended that leadership get an adequate baring on the culture of SOGC and how it fosters innovation, creativity, and inclusiveness. An audit of the current culture, conducted through a survey and focus groups will ground the CDO and leadership into how open employees are to change, innovation, and the inclusion of people and perspectives. Research has shown that the upside of digital transformations is that it creates opportunities to foster a workplace that is more diverse and inclusive, but to do this it is necessary to understand where SOGC is today.

[26] 'Transformer in chief': The new chief digital officer https://www.mckinsey.com/business-functions/organization/our-insights/transformer-in-chief-the-new-chief-digital-officer

Digitization fosters diversity and inclusion in four key aspects. It is recommended that SOGC and the leadership team involved in the transformation utilize these opportunities to transform the culture at SOGC. [27]

1. **It standardizes learning and professional development.** As the business infrastructure becomes digitized, the entire workforce will need to learn and upskill in order to sustain the business. Those who do not buy-in to this growth mindset and learning culture will be left behind. The idea of showing up to work without a commitment to this culture will be impossible in the new SOGC.

2. **It levels the playing field when judging employees' performance.** By promoting those who show technical excellence and a willingness to learn, leadership can promote innovation and creativity. A clear merit-based promotion scheme that focuses on technical knowledge will let employees know what leadership values and allows an openness of who is knowledgeable in certain aspects of digital. Managers within SOGC will be empowered to use clear metrics and objectives to promote, leaving less room for subjective or biased reviews.

3. **It changes the nature of the work, requiring more inclusion.** Digitizing goes hand-in-hand with flexibility and ease. If done right, many of the roles within SOGC can become remote, communication across functions and groups is smoother, and opportunities to increase employee satisfaction arise.

4. **It requires a new recruitment strategy to fill the new digital positions.** Companies that were successful in digitizing their business realized the need to change their recruitment process. There are many approaches that can be taken here, but the important thing is to have a clear understanding of the technical expertise required, where to find that expertise, and how to

[27] How to Leverage Digital Transformation to Make Workplaces More Diverse and Inclusive https://www.forbes.com/sites/amitymillhiser/2020/01/27/how-to-leverage-digital-transformation-to-make-workplaces-more-diverse-and-inclusive/#3ca9bdf9549d

supplement those skills with the skills required to be successful within Oil & Gas.

SOGC will be primed with different opportunities and avenues to change the culture of the company. These four aspects, when done in conjunction can make a successful digitization effort while fostering an open and inclusive culture.

2. *Recruitment and Development*

   Recruiting will be paramount for the success of SOGC's digitization. Their efforts should be split and focused on two key areas: University Recruiting and Experienced Hire Recruiting. Additionally, with a lot of new positions required that aren't typically associated with Oil & Gas, SOGC has an opportunity to revamp its diversity recruiting and be the industry leader in attracting and retaining underrepresented groups to support this digital strategy. Once the CDO and leadership are in place for the digital transformation, in parallel recruiting should be revamped to match the newly digitized SOGC.

   a. University Recruiting

   At a high level, university recruiting offers many benefits, the main ones being students present a wide variety of backgrounds, are all available at the same time and place, and partnerships with the schools can give a company an upper hand against the competition. SOGC and other players in the industry have traditionally stuck to hiring certain degrees from certain geographies and institutions[28], but with a digital transformation, SOGC must expand their university recruiting and prioritize it over experienced hire recruiting. To successfully set themselves up for success, SOGC should focus on the following areas over the next five years:

   - HR and the new CDO audit current practices to understand best practices and gaps.
   - The CDO and CHRO work in conjunction to define hiring needs for digitization.
   - Establish new partnerships with schools and professional programs.

[28] Recruiting in Oil and Gas
https://www.academia.edu/1412101/Recruiting_strategies_for_Oil_and_Gas_Corporations

- Revamp the interview process to adequately screen candidates.
- Develop an onboarding process that lays a powerful foundation for new hires.

b. Experienced Hire Recruiting

Over the next five years, SOGC should leverage two key channels for sourcing senior engineers, technical managers, and directors/executives: referrals and agencies. SOGC can make employee referrals effective by offering a lucrative bonus for technical managers or higher. Agencies provide an opportunity to "outsource" this hiring process to an external party and use them as a proxy as SOGC treads into a different hiring scheme. An agency can also free up the CDO and CHRO to focus on university/diversity recruiting and retention. Finally, in the long-term the majority of managers within SOGC should be university hires that have been developed internally and are ready to succeed the retiring senior leadership.

c. Diversity Recruiting

The Oil & Gas industry is behind when it comes to underrepresented minorities numbers, and the numbers are even worse the more senior the position is. Within Oil & Gas, African Americans only make up 6.7% of the workforce, compared to 12% of the US workforce.[29] The industry has always been dominated by white males, and if that were to continue SOGC would not be able to attract all the talent they need to fuel their digitization. SOGC can meet these needs by focusing on the following areas over the next five years:

- Establish relationships with HBCUs and offer free training/education on Oil & Gas.
    - Offer an internship program specifically for underrepresented minorities

[29] Not Enough Talent For The Energy Workforce? Energy's Diversity Problem May Be The Solution https://www.forbes.com/sites/uhenergy/2019/02/01/not-enough-talent-for-the-energy-workforce-energys-diversity-problem-may-be-the-solution/#6944207d3f97

        - Offer tuition assistance for master's programs or returning interns

    - Partner with underrepresented minorities professional programs.

        - Management Leadership 4 Tomorrow (MLT), Thurgood Marshall College Foundation, National Society of Black Engineers (NSBE), INROADS

    - Hire a diverse Human Resources (HR) team and utilize minority senior managers in recruiting season.

3. *Retention and Development*

   Retention and development are important aspects that are sometimes overlooked during a major effort like this and are usually overshadowed by the work done for hiring. The problem with this approach is that hiring may be fixed but attrition will continue to occur, and it gets expensive quickly when companies need to constantly re-hire for their vacant positions. SOGC will already be focused on revamping the culture of the company for a successful digitization, so they should pay attention to what they can do to make SOGC an appealing place to work for their employees.

   To retain talent, SOGC must offer benefits that their competitors can't match. Companies today are finding compensation isn't enough and must differentiate in other ways[30]. SOGC should focus on the following if they are looking to pull ahead of the competition and retain their talent:

    - Build an appealing and strong work environment with Employee Resource Groups.
    - Revamp the review process for promotions and base it more on technical merit.
    - Have a strong tendency to promote from within and have clear career progressions.
    - Start sponsorship and mentorship programs headed by successful senior leaders.

   Finally, SOGC will need to make sure they focus on developing a strong workforce that can upskill and keep up with the trends

[30] "How to Develop a Talent Pipeline for Your Digital Transformation": https://hbr.org/2019/11/how-to-develop-a-talent-pipeline-for-your-digital-transformation

within Oil & Gas and technology more broadly. To do this, SOGC can outsource the training for a few years as they develop their own internal training. This will require the hiring of dedicated training managers and an audit of the current training programs at SOGC. As mentioned before, the culture of the organization must also lean into growth, innovation, and learning so SOGC can hold hackathons and lunch & learns to foster everyone's development.

V. Looking Ahead – Super Oil and Gas Corporation Recommendation

For SOGC to attain digital leadership, the next phase of digitalization would entail several key work streams: (1) the creation of a planning and strategy development team, (2) the technical digital transformation operations, and (3) a well-planned hiring and retention plan for employees across all levels. In general, all operations need to be headed by leadership at the executive level and have the full support of SOGC.

Additionally, when SOGC completes these different engagements, they should benchmark their digital strategy with the industry to determine next steps. The recommendations below assume SOGC is currently on par with the industry standard in term of digitalization and hiring practices.

1. Planning and Strategy Development Team

In order to truly excel at digital transformation, SOGC must have a team acutely focused on the digital process. As such, the creation of an internal digitalization R&D and strategy team, to benchmark, plan and oversee the different stages of the digitalization process is essential.

2. Digital Transformation

There are three key components of SOGC's digital transformation: (1) the digital twinning of all legacy assets, (2) the addition of sensors on all applicable assets, and (3) implementation of complete data digitization. The digital twinning of assets provides a digital version of every asset that can then be used for simulations, modifications and maintenance pre-planning, and augmented reality. The addition of sensors allows easy monitoring and tracking, and automation controls that would help automate their value chain. Finally, it's important to implement complete data digitization, including automatic AI-driven analysis, and data visualization. This should create end-to-end data collection that includes all operation and back office units, cloud storage, predictive analysis, and interactive visualization dashboards.

Prioritization or rather scheduling of digital transformation initiatives are below.

1. Sensor Addition
2. Data Collection
3. Digital Twinning

3. Hiring and Retention Efforts

SOGC needs to broaden recruitment efforts to include automated candidate sourcing and re-discovery to reduce bias, and simulation-based and coding repository recruiting. This will attract highly skilled specialized candidates, like data scientist and UI/UX designers, required for this next phase of digital transition. The hiring and retention efforts will be composed of four different parts: Training and Development, Overall Hiring Strategy, Diversity Hiring, and Retention Planning. These efforts are mapped out over a five-year period. It is important to note that all portions of the training/development and hiring/retention initiatives need to work together to establish these principles and achieve hiring goals. Teams share a common desire to better the company and effective communication is a necessity.

The training and development plan comprises of three key parts: (1) outsourcing training and development, (2) developing in-house training, and (3) fostering a learning culture. These initiatives and the respective timelines can be found in Exhibit 1.

The overall hiring plan comprises of five initiatives: (1) hiring a CDO, (2) having HR audit current practices and establish best practices, (3) the CDO/CHRO defining all hiring needs, (4) establishing a referral program for technical managers, and (5) developing a solid on boarding process. Details regarding this step can be found in Exhibit 2.

Diversity hiring is the next portion of the overall hiring and retention efforts. This section relies on four key initiatives to succeed. First, there must be the establishment of new recruitment channels. Second, SOGC should seek out partnerships with Historically Black Colleges and Universities (HBCUs). Third, it will be extremely important to revamp the interview process in order to capture the correct talent pool. Finally, SOGC should actively seek out partnerships with underrepresented minority professional groups, such as the National Society for Black Engineers (NSBE). Further details are located in Exhibit 3.

The retention plan relies on four key areas: (1) building an appealing and strong work environment, (2) revamping the review process for promotions, (3) promoting from within the company, and (4) establishing mentorship and sponsorship programs. SOGC will need to effectively deploy all four initiatives to complete the retention strategy. Additional details are located in Exhibit 4.

VI. Exhibits

Exhibit 1: Five Year Plan | Training and Development

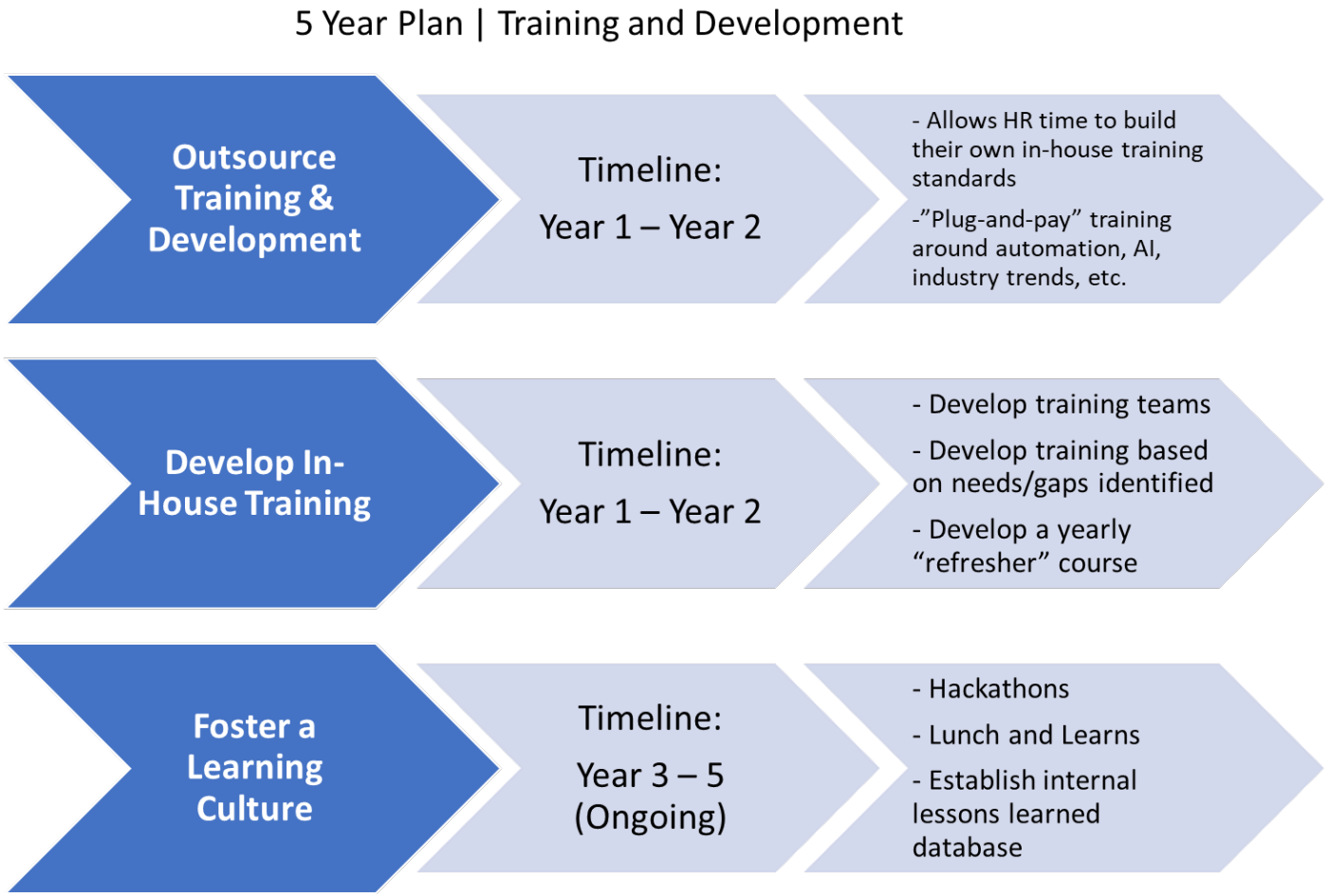

Exhibit 2: Five Year Plan | Overall Hiring Plan

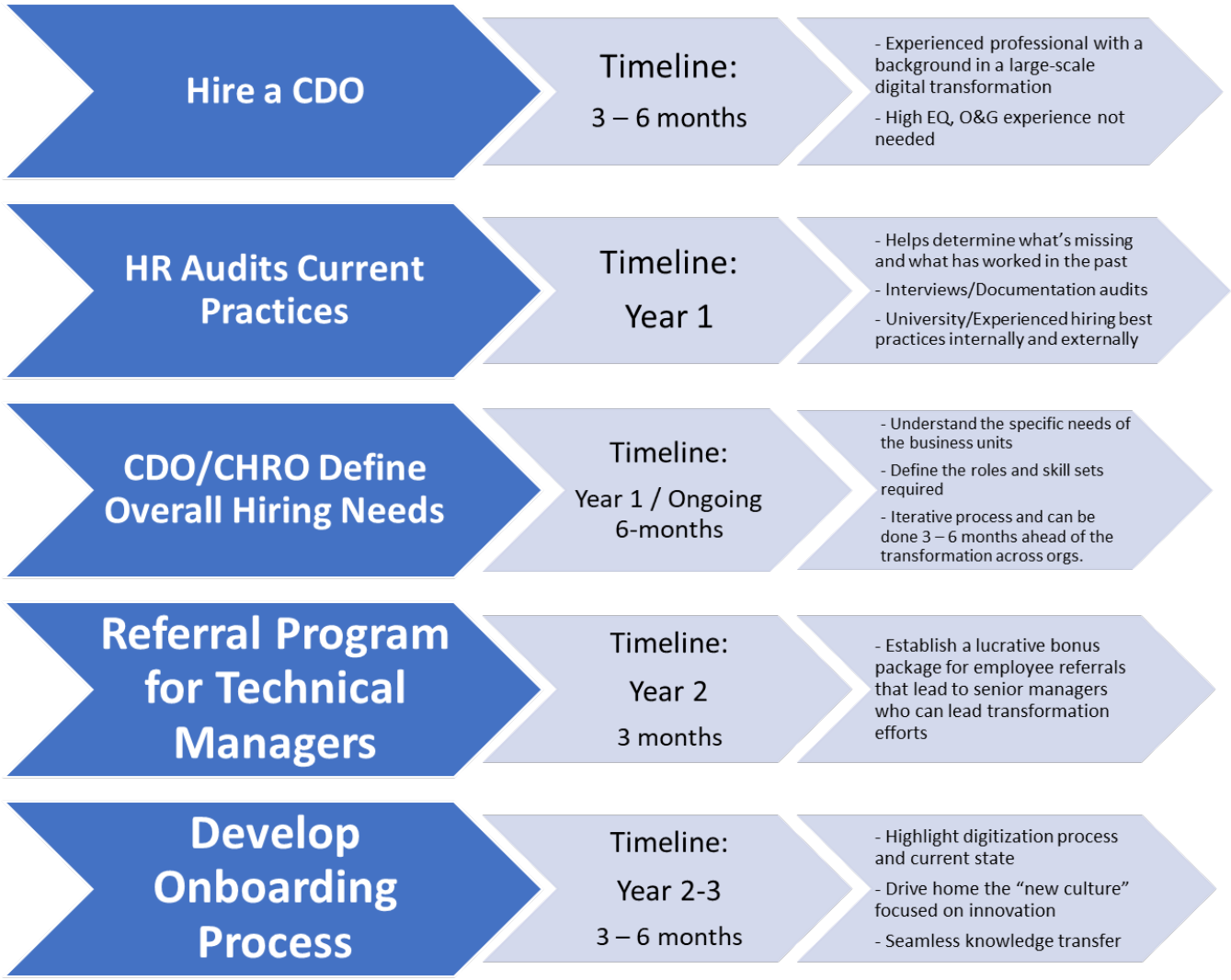

Exhibit 3: Five Year Plan | Diversity Hiring

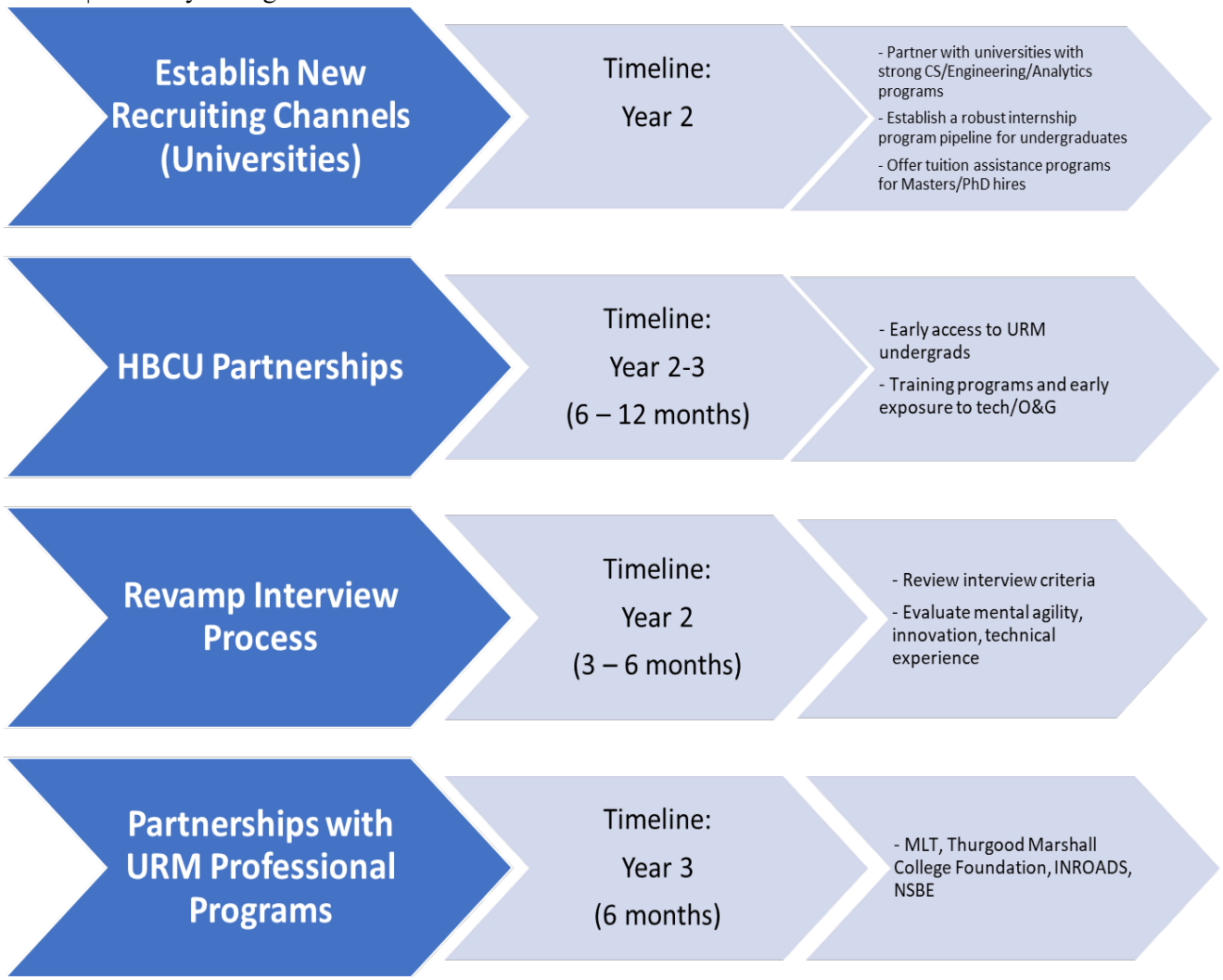

Exhibit 4: Five Year Plan | Retention