A HOLISTIC REFERENCE FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN THE UPSTREAM UAE OIL AND GAS

A thesis submitted to the
University of Petroleum and Energy studies

For the award of
Doctor of Philosophy
in
Management

BY
Sylesh Nechully

August 2019

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DECLARATION

I declare that the thesis entitled "A HOLISTIC REFERENCE FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM UAE OIL AND GAS" has been prepared by me under the guidance of Dr. S. K. Pokhriyal, Professor of Oil and Gas, Energy Management, SoB, University of Petroleum and Energy Studies. No part of this thesis has been formed the basis for the award of any degree or fellowship previously.

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THESIS COMPLETION CERTIFICATE

This is to certify that the thesis on "A HOLISTIC REFERENCE FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM UAE OIL AND GAS" by SYLESH NECHULLY (SAP ID 500043957) in partial completion of the requirements for the award of the Degree of Doctor of Philosophy (Management) is an original work carried out by him under my supervision and guidance. It is certified that the work has not been submitted anywhere else for the award of any other diploma or degree of this or any other University.

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ABSTRACT

Adoption of innovation is a slow process irrespective of industries/sectors. The researcher decides to narrow down his study on Innovative Drilling Technologies in Upstream UAE Oil and Gas. The slow pace of adoption results in delayed or missed opportunities for cost savings and profitability. The researcher formulates his Research problem as to "Find the role of variables affecting the different stages of adoption of innovative drilling technologies in Upstream UAE Oil and Gas."

The theoretical underpinning selected was Frambach and Schilleweart model of adoption, which posits that for an organization to derive benefits out of innovation, it is not only enough that the organization has adopted the innovation, but the employees should also utilize the innovative in the day-to-day operations of the organization. Innovation Adoption has two dimensions of "Adoption by the Organization" and "Utilization by the end-users." The Theoretical Gap was that the model did not propose "Pre-Adoption Variables." Knowledge of "Pre-Adoption variables" is required to create an environment conducive for adoption to take place – manipulating the Pre-Adoption variables facilitate the transition from "Pre-Adoption Stage" to "Adoption Stage."

Aligning the Theoretical Gap with the Research problem, the researcher states the Research Objectives as (1) To find out the relevant variables affecting the different stages of adoption (With special emphasis to Pre-Adoption Variables) (2) To propose a Framework to enhance the adoption of innovative drilling technologies (Covering the entire Gamut of adoption with special emphasis to Pre-Adoption Variables).

The Researcher uses a qualitative approach of study to explain "how?" the variables or enablers can enhance innovation adoption. The researcher adopts "Grounded Theory" as the appropriate research method for Research Objective (1) – To identify the relevant variables affecting the adoption and "Framework

Analysis" as the appropriate research method for Research Objective (2) – To propose a Framework to enhance the adoption.

The output of Research Objective 1 goes as an input to Research Objective 2. Since Abu Dhabi dominates the UAE Oil and Gas sector and ADNOC Oversees the Oil and Gas activities in Abu Dhabi – Study of Upstream ADNOC Group of Companies gives a "Pulse" of Upstream UAE Oil and Gas sector. The Researcher interviewed 15 people from ADNOC Offshore, ADNOC Drilling, and ADNOC Onshore. The Researcher selected respondents whose designation – Senior Engineer and above till Team Manager with more than 20 years of experience were selected for the interview. Semi-Structured Interviews were conducted to collect data as it allows the researcher to add a new question or to rephrase the questions as or when the situations demand. The data analysis starts with the construction of a conceptual lens from the Literature Review. The Researcher uses the conceptual lens to draft the Interview Protocol.

The output framework from the first stage of data analysis – for finding the relevant variables becomes the conceptual lens for further framework analysis – to propose the framework. Framework analysis has four stages of data analysis – first two stages of familiarization followed by the last two stages of interviews. The research method followed for the first two stages of Framework Analysis is Document/Content Analysis, and for the last two stages is Grounded theory. The output from one stage becomes the conceptual lens for the subsequent stage. Interview protocol is also revised accordingly. The output framework that emerges from the fourth and final stage of framework analysis is the ultimate validated framework to enhance the innovative drilling technologies in upstream oil and gas.

This framework helps to identify the role played by variables/enablers at different stages of adoption. The organization can manipulate variables/enablers for the transition from one stage to subsequent stages. The researcher infers that (1) A Favorable Attitude (2) High levels of Organizational Readiness (3) High Intention

to use and (4) Re-Purchase/Substitution/New Purchase decisions speeds up the adoption process. The aforementioned are the four main variables – Organizations can identify variables and sub-variables from the framework.

The Framework helps organizations to make Variable/Innovation/Adoption stage-specific strategies to enhance the adoption. The Study on Pre-Adoption variables is the contribution to theory. The Researcher enriches the base model – Frambach and Schilleweart model by adding Pre-Adoption Variables.

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First and Foremost – Prayers and Thanks to "Lord Ayyappa" for bestowing upon me his blessing throughout the research work.

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Last but not the least, I would also like to thank – Mrs. Rakhi Ruhal for the valuable administrative support provided during research – her swift replies to my emails and frequent reminders – helped me to be on track. I am also indebted to

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RESEARCH MOTIVATION

The Researcher deals with the end-users of ADNOC on a day to day basis. While discussing about the innovative technologies, the end-users often remark “We are not getting the X technology”, “I am sure it will not go through”, “We want the innovative technology “Y” in six months, but I am sure it will take a minimum of 2 – 3 years for them to consider”, “Very difficult to convince”, “Happy with what we have, why to take unnecessary headaches” and “Ho! The process takes years”. There are many innovative technologies available in the market, and the end-users need it in the plant. But the adoption of Innovative Technologies is slow in UAE Oil and Gas. It’s a fact to be acknowledged. Some variables slow down the Innovation adoption – But, what are those variables? Has anyone made a systematic study regarding the adoption of innovative technologies in UAE Oil and Gas? These questions aroused the inquisitiveness of the researcher and encouraged him to pursue the matter further. On a personal front, the researcher has an interest in idea incubation, entrepreneurship, and Diffusion/Adoption of innovation.

Moreover, the market is becoming very competitive and qualification conscious. For climbing the corporate ladder, the market demands qualifications plus professional skills. A Ph.D. in Oil and Gas will propel the career of the researcher to new heights. The aforementioned reasons motivated the researcher to pursue a Topic related to Innovative technologies in Oil and Gas for Ph.D. But “Innovative Technologies in Oil and Gas” is a vast topic – lack the “specificity” of the research. There are many innovative technologies available for different streams of Oil and Gas. The confusion regarding the technology and stream forced the researcher to explore the “feasibility aspect” of research. Selecting a fancy topic with attractive terminologies is one thing, and concluding the topic of study is another thing. “Feasibility of Data collection” is a vital aspect to be considered while selecting the topic. Researcher interacts with Upstream Oil and Gas

professionals on a day to day basis. So collecting data from upstream oil and gas professionals is feasible. Narrowing down on the technology, the researcher decides to concentrate on “Innovative Drilling Technologies.” So the Topic narrows down to “Innovative Drilling Technologies in Upstream UAE Oil and Gas” and the researcher decides to study the adoption from the end-user’s perspective. So the Topic of Research narrows down to “Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas.” The Researcher Tentatively proposes the Title of Research as “A Holistic Reference Framework to Enhance the Adoption of Innovative Drilling Technologies in the Upstream UAE Oil and Gas.” The Researcher has to establish the Business Problem, Research Gaps, “Research Problem,” Research Objective(s), Research Method(s) and ultimately propose Solution(s) for the Research Problem. The Researcher finalizes on the “Title of the Research” only after establishing the Research Gap(s) and Research Objective(s).

Now the Research Journey Begins.

OVERVIEW OF THE RESEARCH

The Researcher gives a Prelude to the Topic under study by briefly describing the UAE Oil and Gas Sector in Chapter 1 – "UAE Oil and Gas Sector – An Overview." The Researcher describes the structure of UAE Oil and Gas, Main players, ADNOC Supply Chain, and some of the recent developments worth mentioning.

In Chapter 2 – "Importance of Innovative Drilling Technologies in Upstream UAE Oil and Gas," Researcher explains the Importance of Innovative technologies, Various Innovation Initiatives by UAE Government, Pace of adoption, and Impact of Non/Slow adoption.

The Researcher does the Literature Review on Theories and Model of Adoption in Chapter 3. The effort has been made to review early theories in Anthropology and very recent theories on Technology acceptance. Roger's Diffusion of Innovation Theory forms the basis of many theories on Innovation adoption.

In Chapter 4 – "Selecting the Theoretical Underpinning and Theoretical Gap", the researcher narrows down on Frambach and Schilleweart model of adoption as the appropriate theory to explain the Innovation adoption. Organizations/Researchers should study adoption from the perspectives of "Organizational Adoption" and "Employee Utilization." But the theory is silent on Variables affecting the Pre-Adoption Stage.

The Researcher aligns the Theoretical Gap with the business problem, states the Research Gaps, Research Problem, and Research Objectives in Chapter 5. The Title of the Research is finalized as "A Holistic Reference Framework to Enhance

the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas."

In Chapter 6, the Researcher describes the Research design for the study. The researcher selects ADNOC Upstream Companies @ Abu Dhabi for data collection – to get the pulse of Upstream UAE Oil and Gas. Abu Dhabi holds 96% of Crude reserves, and 92% of Natural Gas reserves and ADNOC oversees the Oil and Gas activities in Abu Dhabi. The Researcher selects Grounded Theory as the research method for Research Objective 1 and Framework analysis for Research Objective 2.

The Researcher describes the Research Flow in Chapter 7. The output of one stage becomes the input to the subsequent stage. The framework that emerges after the Fourth and Final stage of Framework analysis becomes the Validated Framework – Framework to enhance the adoption of innovative drilling technologies.

In Chapter 8 – The RO1 is answered. The relevant variables are identified using Grounded Theory.

In Chapter 9 – The RO2 is answered. A framework is proposed to enhance the adoption of innovative drilling technologies.

The Researcher explains the Variables in Chapter – 10. Insights obtained during different stages of data analysis are consolidated to get a better understanding of the adoption variables / process.

Chapter 11 - deals with strategies to enhance the adoption of innovation. This chapter answers the Research Problem.

Chapter 12 – describes the practical implication of the research work – worth mentioning is the assessment of “current state” and “desired state” of variables to enhance the adoption of innovative drilling technologies.

Chapter 13 – describes the influence of pre-adoption variables on the process of adoption – enriches the base model: Frambach and Schilleweart model with Pre-Adoption variables. The contribution to the industry is a validated framework that can enhance the adoption of innovative drilling technologies. The Researcher also furnishes the Limitations and future scope of research in this chapter.

LIST OF SYMBOLS

×	: Multiplication
∑	: Summation

LIST OF ABBREVIATIONS

A	: Adoption
ADNOC	: Abu Dhabi National Oil Company
B/d	: Barrels per day
CAPEX	: Capital Expenditures
CEO	: Chief Executive Officer
CEPSA	: Spanish Petroleum Company
CIPD	: Chartered Institute of Personnel Development
CT	: Contract Finalization
E&P	: Exploration & Production
EBIT	: Earnings before Interest and Taxes
EPC	: Engineering, Procurement and Construction
F	: Future Usage
I	: Implementation
ICV	: In Country Value
IO	: Innovation Opportunity
KBR	: Kellogg Brown and Root
LNG	: Liquefied Natural Gas
LPG	: Liquefied Petroleum Gas
MOE	: Ministry of Economy

NOC : National Oil Company

O&G : Oil and Gas

OECD : Organization for Economic Co-operation and Development

OMV : Österreichische Mineralölverwaltungs Aktiengesellschaft

ONGC : Oil and Natural Gas Corporation Limited

OPEC : Organization of the Petroleum Exporting Countries

PA : Pre-Adoption

PT : Post – Adoption

PwC : PricewaterhouseCoopers

R&D : Research and Development

Re-appr : Re-Appear

RO1 : Research Objective One

RO2 : Research Objective Two

RRPCL : Ratnagiri Refinery and Petrochemicals Limited

SPC : Supreme Petroleum Council

T/y : Tons per year

TAM : Technology Acceptance Model

TF : Technology Finalization

U : Utilization

UAE : United Arab Emirates

UK : United Kingdom

US : United States of America

UTUAT : United Theory of Acceptance and Use of Technology

Var : Variable

Webex : CISCO Webex

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CHAPTER 1

UAE OIL AND GAS SECTOR – AN OVERVIEW

1.1 INTRODUCTION

UAE holds 7th largest Oil and Gas Reserve of the world (97.8 Billion Barrels of Oil and 215 Trillion Cubic Feet of Natural Gas (ADNOC, 2019). Abu Dhabi holds 96% of the reserves and the remaining 4% is scattered across the other Emirates of Dubai, Ajman, Ras Al Khaimah, Fujairah, Umm Al Quain, and Sharjah. UAE's Oil and Gas production increased by 20% from 2009 to 2018. The production of crude oil increased to 2.97 Million B/d and Natural Gas to 3,179 Bcf (Usuaebusiness, 2019). UAE supplied 2.5 Million B/d of crude oil to the Non-OPEC countries in 2017-18 under Long Term Contracts. UAE meets 87% of its power requirement from Natural Gas (Usuaebusiness, 2019). The UAE was not able to meet the increased domestic demand for natural gas. The domestic consumption of gas grew up 5% annually (2005-2015). By 2008, UAE became a net importer of Natural Gas (UAEinteract, 2017).

The Oil and Gas Sector contributes 30% of the Country's GDP (Internations, 2017). UAE has four refineries in Fujairah, Jebel Ali, Umm Al Nar, and Ruwais (Ahmed, 2015). Supreme Petroleum Council formed in 1988 oversees the complete Oil and Gas activities in UAE (UAE Trade and Commercial Office, 2017)

1.2 MAIN PLAYERS IN UAE OIL AND GAS

The main players in the UAE Oil and Gas markets are Abu Dhabi National Oil Company, RAK Gas, Emirates National Oil Company, and Sharjah National Oil Company – All NOCs. The main International Oil Companies executing projects with NOCs are Occidental Petroleum, Eni, Total, Shell, Exxon Mobil, China Zheu

Hua Oil Company, China National Petroleum Corporation, OMV, ONGC, and Cepsa (Usuaebusiness, 2019).

ADNOC dominates the UAE Oil and Gas market managing 95% of Crude reserves and 92% of the Natural Gas reserves. A study of the ADNOC Group of companies helps to identify the pulse of UAE Oil and Gas market (Usuaebusiness, 2019).

1.3 ADNOC SUPPLY CHAIN

1.3.1 – UPSTREAM

ADNOC Onshore operates in shallow coastal waters and onshore. It exports crude oil to the overseas market from Fujairah and Jebel Dhanna Terminal. ADNOC Offshore operates Oil and Gas resources in Abu Dhabi waters. ADNOC Drilling drills both Onshore and Offshore for Oil in Abu Dhabi. Al Yahsat Petroleum and Al Dhafra Petroleum are young Upstream companies focusing on developing the untapped Oil and Gas reserves in UAE (ADNOC, 2017).

ADNOC GROUP CORPORATE STRUCTURE		
Exploration & Production	**Processing & Refining**	**Marketing & Distribution**
ADNOC Onshore	ADNOC Gas Processing	ADNOC Distribution
ADNOC Offshore	ADNOC Sour Gas	ADNOC Logistics & Services
ADNOC Drilling	ADNOC LNG	Abu Dhabi National Crude Oil Pipeline (ADCOP)
Al Yasat Petroleum	ADNOC Refining	
Al Dhafra Petroleum	ADNOC Industrial Gas	
	Abu Dhabi Polymers Company (Borouge)	

Figure 1. 1 ADNOC Corporate Structure (adapted from Usuaebusiness, 2019)

1.3.2 – MIDSTREAM

ADNOC Gas Processing produces Natural Gas and supplies it to ADNOC LNG at Das Island where it is processed, and LPG/LNG transferred to ships for export. ADNOC Sour Gas produces One Billion Cubic Feet of Ultra Sour Gas per day. ADNOC Refining produces granulated sulfur and various petroleum products. ADNOC Fertilizers supplies Ammonia and Urea mainly to India. ADNOC Industrial Gas formed in 2007, supplies Industrial Gases to Petrochemical and other Oil and Gas sectors. Borouge manufactures Polyolefin – Polypropylene, and Polyethylene (ADNOC, 2017).

1.3.3 – DOWNSTREAM

ADNOC Distribution oversees the operation of Petrol stations across UAE and provides aviation fuel services to airports across the country. Abu Dhabi Crude Oil Pipe Line LLC operates the 406 Kms pipeline from Habshan to Fujairah Oil Export Terminal, facilitating export to foreign markets. ADNOC Logistics and Services provide logistics services to ADNOC Companies and International Customers (ADNOC, 2017).

1.4 SOME OF THE RECENT DEVELOPMENTS

Till 2016, ADNOC had a very conservative approach towards domestic and international oil and gas market. But the appointment of H.E. Dr. Sultan Ahmed Al Jaber changed the entire scenario. The New CEO streamlined the operations and corporate structure to enhance the efficiency and profitability of operations (Wisconsin, 2017). H.E. Dr. Sultan Ahmed Al Jaber with the blessings of SPC, launched the 2030 Integrated Strategy in 2017. ADNOC's 2030 Integrated Strategy identifies 5 major shifts in the energy market: (1) Increase in Oil demand (10 Million barrels per day by 2040) (2) Increase in Petrochemical Demand (By 60%) (3) Emergence of Asia – Pacific Market (4) Increase in Natural Gas demand

(45% by 2040) (5) To enhance efficiency 5 to 10% by digitalization (Usuaebusiness, 2019).

SPC has allocated a budget of $132.33 Billion for Upstream to enhance production capacity to 5 Million B/d by 2030 and $45 Billion for Downstream. UAE targets to achieve a cost recovery of 70% by 2030 (Usuaebusiness, 2019).

Some of the recent developments worth mentioning in UAE Oil and Gas:

- In October 2018, Baker Hughes acquired a 5% stake in ADNOC Drilling (Usuaebusiness, 2019).
- In November 2018, ADNOC awarded an EPC Contract to Technicas Reunidas for Buhasa Field Development for $1.4 Billion – to increase production from 550,000 B/d to 650,000 B/d by the end of 2020 (Usuaebusiness, 2019).
- Exploration and Production Licenses to be awarded for the first time by International Bidding in 2019 (Usuaebusiness, 2019).
- ADNOC joined hands with Eni, Wintershell, OMV, Bechtel, Technip FMC and KBR for developing Hail, Ghasha, and Dalma fields to cover up 20% of the Gas requirement by 2025 (Usuaebusiness, 2019).
- ADNOC has plans to increase refining capacity two-fold and triple the production of petrochemicals by 2025 (Usuaebusiness, 2019).
- ADNOC has joined hands with Total to develop Ruwais Diyab and Ummshaif fields (Usuaebusiness, 2019).
- In September 2018, ADNOC awarded an EPC contract to Maire Tecnimont to construct a fifth Polypropylene plant – which will increase the capacity of Borouge by 25% to 2.24 Million t/y by late 2021 (Usuaebusiness, 2019).
- ADNOC has awarded the project to construct a facility capable of producing Linear Alkyl Benzene – 150,000 tons/year to Cepsa (Usuaebusiness, 2019).

- ADNOC plans to enhance its refining capacity by 600,000 B/d – by building a new refinery (Usuaebusiness, 2019).
- ADNOC LNG has awarded an EPC Contract for Phase – II of IGD-E, which will add 245 Million Cubic Feet of associated gas per day (Usuaebusiness, 2019).
- ADNOC has formed a long term price agreement of 10 years to supply 1 Million metric tons of LPG per year to Wanhua Chemicals, China in November 2018 (Usuaebusiness, 2019).
- ADNOC has acquired 50% stake with Saudi Aramco in RRPCL to build a mega refinery of 1.2 Million B/d capacity with a budget of $44 Billion (Usuaebusiness, 2019).

The researcher has already published a paper on UAE Oil and Gas titled – "UAE's Oil & Gas Industry – A Bird's Eye View." – in Appendix A.

1.5 CHAPTER CONCLUSION

The Researcher gives a bird's eye view of the current UAE Oil and Gas, its structure, and the latest developments. A thorough understanding of the market or segment is very much essential to narrow down on the "Research Topic" at the later stage of research.

CHAPTER 2

IMPORTANCE OF INNOVATIVE DRILLING TECHNOLOGIES IN UAE OIL AND GAS

2.1 INTRODUCTION

There are many innovative technologies available in the market for adoption in the Oil and Gas in different streams – Upstream, Midstream, and Downstream (Stout, 2014). The researcher decides to narrow down his study on innovative drilling technologies in Upstream UAE Oil and Gas.

2.2 RELEVANCE OF INNOVATIVE TECHNOLOGIES IN OIL AND GAS TO UAE ECONOMY

Oil and Gas contribute 30% of the country's GDP and 20% of the total export revenue. UAE has plans for economic diversifications – but even for that revenue from Oil and Gas are significant in the short and medium terms (Fayad, 2016). Moreover, Oil and Gas from various quarters inundates the international scenario. Oil and Gas will be facing stiff competition from alternative sources of energy very shortly (MOE, 2015). The prices for oil and gas are not expected to increases drastically in the coming years (World Economic Forum, 2017). All the above-stated reasons call for the adoption of innovative technologies to increase efficiency, lower cost, and enhance the profitability of operations (Reinsvold, 2016; Rigzone, 2017; Sawyer, 2016).

2.3 SIGNIFICANCE OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM UAE OIL AND GAS

The probability of finding new hydrocarbon deposits in the UAE is low. The sharp decline in oil and gas prices has depleted the profit margins for the ADNOC Group of Companies (CIPD, 2016; Maceda, 2015). Innovative drilling technologies can (1) Increase the production levels from maturing oil fields,

decreasing the cost per barrel. (2) It can drastically decrease the Capital and Operating costs (Sawyer, 2016). Innovative drilling technologies can enhance production by 2 to 8%, reduce the capital cost by 1 to 3%, and operating cost by 5 to 25% (Blair, 2016).A moderate case of innovative drilling technologies adoption can unlock the value of $230 Billion, and Technology acceleration can result in a value of $290 Billion (Choudhry et al., 2017). For a company like ADNOC, innovative drilling technologies can increase the EBIT bottom line by 11% (Accenture Consulting, 2016). Innovative drilling technologies can increase the Present Net Value of the assets by 25% (Stout, 2014). For a typical $50 Billion company, innovative drilling technologies can result in the decrease of production and lifting cost by $590 Million, decrease CAPEX by $122 Million and increase drilling efficiency by $113 Million (Accenture Consulting, 2016). Innovative technologies can reduce unplanned outages by 50% (Heps and Rosendhal, 2012).

2.4 GOVERNMENT INITIATIVES ON INNOVATION IN UAE

Apart from the earlier stated 2030 Integrated Strategy, there are many initiatives from the UAE Government to promote innovation in the UAE. UAE Vision 2021 – calls for coordination of three sectors – Government, Academic Institutes, and Private Sector to promote innovation activities in the economy (UAE Ministry of Cabinet Affairs, 2015). Mohammed Bin Rashid Innovation Fund set aside AED 2 Billion each year to promote innovation in the UAE (UAE Ministry of Finance, 2017). UAE National Innovation Strategy sets the policy framework for innovation and focusses on (1) Space (2) Water (3) Technology (4) Health (5) Transportation (6) Renewable Energy (7) Education (UAE Ministry of Cabinet Affairs, 2015). Takamul is an initiative from Abu Dhabi Government to promote commercialization of innovation. Takamul has a "Technology Development Committee," which makes feasibility studies regarding the innovative ideas from Emiratis and Expats alike (Takamul, 2017). According to the Global Innovation Index, UAE stands first among Middle Eastern countries and 36th globally (World Economic Forum, 2018)

2.5 PACE OF TECHNOLOGY ADOPTION IN UAE OIL AND GAS

Despite of all these government initiatives, Technology adoption is generally slow in Oil and Gas. Oil and Gas always adopt a very conservative approach to innovative technologies. Till 2016, UAE Oil and Gas was also reluctant to adopt innovative technologies – As ADNOC used to enjoy exorbitant profits due to high prices in the international market (Oil and Gas Authority, 2016; The Lloyd's Register, 2017; UAEinteract, 2017; Aviles, 2015; E&Y, 2017; Hampel, 2014; Ellefsen, 2017; Keystone, 2017; Jarvis & Goddard, 2016). Things have changed since the new CEO has taken charge. The pace of adoption is better now compared to other Middle Eastern Oil and Gas sectors. But still UAE can improve a lot in terms of pace of adoption especially in Upstream Oil and Gas (National Petroleum Council Report, 2007; Ocean News and Technology, 2017; Reinsvoid, 2016; Constas, 2017; Ene, 2016; Gartner, 2016; Gross, 2017; Judah, 2017; Slaughter & England, 2016; Saadi, 2014; Barghouti, 2017; PWC, 2017; Miller, 2012).

2.6 IMPACT OF NON/SLOW ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES

The Non/Slow adoption of innovative drilling technologies results in delayed or missed opportunities for cost-saving and profitability. The difference between a "State of the Art" plant and others with obsolete technologies is around $12.3 Million (The Oil and Gas Year, 2015). The cost of missed production due to lack of adoption of innovative drilling technologies is between 340,000 to 1.7 Million B/d (Blair, 2016). Slow adoption affects the operational efficiency, reliability, asset health, safety, and profitability. The targeted cost recovery by ADNOC – 70% will not be possible without the adoption of innovative drilling technologies (Teles, Tanajura, and Torres, 2016). Lack of adoption of innovative drilling technologies increases the cost of supply by 25%, decreases recovery volume by 35%, decreases well capacity by 150 – 400%, increases the number of wells by 30%, and increases overall cost by 20% (Barghout, G., 2017). Lack of adoption of

innovative drilling technologies increases the drilling and completion cost by 20%, increases inspection and maintenance cost by 25%, increases employee cost by 20% and increase downtime cost by another 20% (BP Technology Outlook, 2017).

2.7 BUSINESS PROBLEM AND RESEARCH OBJECTIVES TENTATIVELY STATED

The Non/Slow adoption of innovative drilling technologies results in loss – results in delayed or missed opportunities for cost savings and profitability. So, to enhance the adoption of innovative drilling technologies, the researcher needs to identify the role of variables influencing different stages of adoption. To achieve this, the researcher formulates the research objectives tentatively as (1) To identify the relevant variables/enablers affecting the adoption of innovative drilling technologies in Upstream UAE Oil and Gas. (2) To propose a Framework to enhance the adoption of innovative drilling technologies in Upstream UAE Oil and Gas. The Research Objectives can be finalized only after identifying and aligning the theoretical gap(s) with Research Problem(s).

The Researcher has already published two papers titled (1) “Significance of Innovative Technologies in Oil and Gas Sector and (2) Adoption of Innovative Drilling Technologies in Oil and Gas – in Appendix B and C

2.8 CHAPTER CONCLUSION

The Researcher proves that the adoption of innovative drilling technologies in UAE Oil and Gas can enhance the bottom line of Oil and Gas companies and can, in turn, impact the UAE economy significantly. But the pace of adoption is slow in UAE Oil and Gas. So, there exists a scope of the study to enhance the speed of innovation adoption – Business problem identified and Research Problem stated tentatively.

CHAPTER 3

LITERATURE REVIEW ON THEORIES AND MODELS OF INNOVATION ADOPTION

3.1 INTRODUCTION

Innovation is "the introduction of something new, or a new idea, method or a device" (Webster, 2017). Anything new to an organization is an innovation (Edison, Ali, and Torkan, 2013). Based on innovativeness, OECD (2005) categorizes innovations to "New to the firm, New to the market, New to the world." Scholars like Dixon (1928) and Schumpeter (1942) have differentiated between invention and innovation. Invention is the act of discovering something entirely new, and innovation is the "act of commercialization' of the invention. Schumpeter (1942) categorizes innovation into (1) New products (2) New markets (3) New methods of production (4) New sources of supply (5) News ways to organize a business. Linton (1936) classifies innovation into (1) Primary Innovation – Entirely new products or processes (Disruptive Innovation) (2) Improved innovation – Enhancement of features of existing products (Incremental Innovation).

The Researcher has already published three detailed papers on Innovation adoption (1) A Journey Through the Evolution of Theories and Models of Adoption of Innovations (Years: 1796 – 1980) (2) A Journey Through the Evolution of Theories and Models of Adoption of Innovations (Years: 1981 – 1999) (3) A Journey Through the Evolution of Theories and Models of Adoption of Innovations (Years: 2000 – 2018). Due to Space/Volume constraints – the Researcher was not able to place those papers in Appendix. The researcher has mainly referred his own papers for Literature Review. The technique of Snowball sampling – "References of References" was used to identify related relevant information from other Research Papers.

3.2 LITERATURE REVIEW

While researching a topic like "Adoption of Innovation," the researcher should have an in-depth understanding of the theories and models of adoption. In the pursuit, the researcher reviewed around 200 relevant theories and models. This literature review also helped the researcher in the construction of "Conceptual Lens" for data collection in the later stages of research.

3.2.1 TILL 1980

Diffusion/Adoption studies first began in the field of Anthropology. Anthropology has 3 Schools of Thought (1) German (2) American (3) British. Scholars belonging to German School of Thought – Frobenius (1898), Father Wilhelm Schmidt (1906) and Graebner (1911) proposed the concept of "Kulturkreise" (Culture Circles) – Area of influence of a particular culture. The similarity of cultural traits is due to the closeness of cultures and environmental adaptations. The local environment modifies or rejects the cultural traits. Scholars belonging to the American school of thought like Clark (1923) and Kroeber (1940) established that a cultural trait is invented once and re-borrowed many times. Scholars like Eliot Smith (1933) and W.J., Perry (1935) believed that all cultures originated in "Egypt" and spread to other parts of the world. Egypt was the "Cradle of Civilization."

Communication theories proposed by Gaudet, Berelson, and Lazarsfeld (1944), Lazarsfeld and Merton (1948) form the basis of Rogers's theory of Diffusion of Innovation. Magic Bullet Theory proposed by Gaudet, Berelson, and Lazarsfeld (1944), assumes customers to be passive and posits that the adoption of innovation happens if the innovator conveys the information about the innovation to the prospects. Two-step flow theory proposed by Lazarfield and Merton (1948) proposes that – Opinion leaders are to be convinced first and if the opinion leaders are convinced, they will, in turn, convince the target market. Laswell Model of communication emphasizes the need to take feedback from the customer

regarding the innovation, and the product has to be modified accordingly (Braddock, 1958). Information Integration Theory proposed by Anderson (1971) explains that the end-users collect information from various sources and assigns a weight to relevant information and integrates the favorable information to make a decision. Revealed Preference Theory proposed by Samuelson (1938) posits that analyzing the past behaviors helps to Predict Consumer Behavior in the context of price and income.

Duesenberry (1949) explains the relevance of the "Reference Group" while making an innovation adoption decision. Customers copy the adoption behavior of the reference group for want of compliance. Social Contagion Theory proposed by Bandura (1977) also supports the concept that individuals copy buying behaviors from others. Casetti (1979) made a further contribution to Social Contagion Theory by establishing the fact that the organizations/scholars should perceive adoption of innovation as a result of the learning process – either from the experience of self or by observing or imitating others. Rayna and Strinkova (2009) proved this "Imitation Effects" for various adopter categories. When the benefits of a product become evident from the usage, a particular adopter set adopts the product and the effect cascades to other adopter sets. The effect of "Charismatic Leadership" was pointed out by Weber (1968).

Individuals always have expectations about innovation. If the innovator cannot match those expectations – dissonances are created. It is the natural tendency of human beings to reduce dissonances by abandoning the current product and switching over to other product. The concept is explained by Cognitive Dissonance Theory by Festinger (1957). McLeod (2008) and Oliver (1980) proved the views of Festinger. A mismatch between the "expected" and "actual" leads to disappointment and early abandonment.

In the practical world, it is not possible to evaluate all alternatives or to collect all information regarding the alternatives available in the market. So an individual

selects a “reasonable” solution to his problem rather than going for an “optimal” solution. Simon (1947) proposed this concept in Bounded Rationality Theory.

Scholars like Fishbein and Ajzen (1975) (Theory of Reasoned Action) and Eagly and Chaiken (1963) explained the role of attitude in adoption decisions. Favorable attitudes strengthen behavioral intentions. Attitude, in turn, is affected by the expectations of the benefits innovation can deliver to the end-users. Triandis (1977) (Theory of Interpersonal Behavior) pointed out that behavioral intentions are not only affected by attitude but also by (1) Habits and (2) Facilitating Conditions.

Neuman and Burks (1966) in “Theory of Automata” considered prospects for innovation as a “Network of Cells” and neighboring cells influence each cell. The cells impart and receive information about innovation to and from other cells. Hagerstand (1965) also explained the same concept in his “Spatial Diffusion Theory.” Greater interactions between the prospects in the market result in faster transmitting of information and thereby enhancing adoption. Actor-Network Theory proposed by Callon (1980) also proposes that the actors in a network influence each other.

Scholars like Jenkins (1949) and Lewin (1947) studied change management and pointed out that “driving forces,” which accelerates adoption should always be greater than “restraining forces,” which retards innovation. Change management follows the three-step process – “Unfreeze the obsolete, Move to the new and Freeze the New.”

Ryan and Gross (1943) studied the adoption of hybrid seed corn in Lowa State and proposed that (1) Personal Network and (2) Mass communication affects the adoption decisions. Griliches (1957) also made the study along similar lines and added variables, namely (1) Market potential (2) R&D (3) Economic Benefits. He proposed the famous “S” curve – Adopter Vs. Time: The adoption takes off slowly, accelerates in due course, and gets saturated.

Roger (1962), in his classic work – "Diffusion of Innovation," explains how innovation gets accepted by the customers in a particular segment or market. Based on the adopter characteristics, Roger divides the adopter set into five categories – (1) Innovators (2) Early adopters (3) Early Majority (4) Late Majority (5) Laggards. The innovator should have different strategies for different adopter sets. Roger also proposed different stages for adoption (1) Awareness (2) Interest (3) Evaluation (4) Trial (5) Adoption. Roger proposed the factors affecting the adoption as (1) Usefulness (2) Ease of Use (3) Fit to Work Settings (4) Ease to learn (5) Word of mouth publicity (6) Availability for Hands-on training. One of the demerits of Roger's theory is that it did not categorically state at which stage of adoption these variables influence.

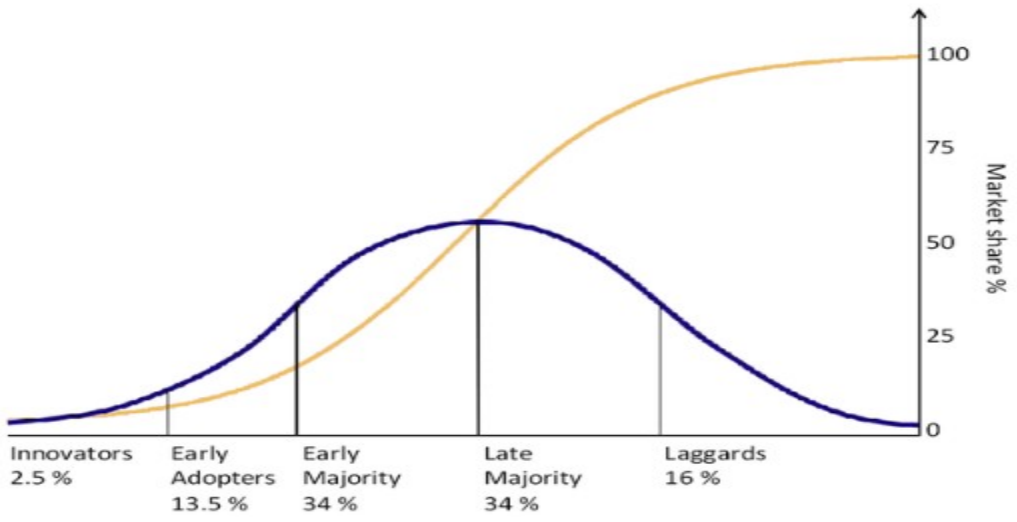


Figure 3. 1 Adopter Categories (adapted from Rogers, 1962)

Robertson (1971) enriched the study of Rogers by adding three more steps (1) Problem Recognition (2) Legitimization (3) Dissonance. Bass Model (1969) attributes the process of diffusion to (1) Innovativeness and (2) Imitative Tendencies of the target market – which further translates to "Curiosity to experiment with something new" and "Learn from the experiences of others." Jain and Rao (1990) added another variable "Price" to the Bass Model.

The relevance of "Perceived Benefits" in adoption decisions was pointed out by Gregg, Hassel, and Richardson (1964) and later by Rosenberg (1972). The same innovation is perceived differently by different customers. The benefits delivered are also valued differently. Only the product which delivers the best value for money to the customers will survive in the long run.

Multi-Stage Innovation Diffusion proposed by Dodson and Muller (1978) explains the influence of advertisement and word of mouth on adoption – The process of converting an "Ignorant" to "Prospect" and subsequently "Prospect" to a "Customer." Contingency model proposed by Midgley and Dowling (1978) states that Innovator should first entice the prospect to the particular product class, then to specific product category and ultimately to product/brand through advertising/word of mouth.

Coale (1973) proposed the need for three conditions to co-exist for adoption to take place – (1) Ability (2) Readiness, (3) Willingness. Granovetter (1978) and later, Russel (1980) proposed a Threshold Model of Innovation. The Theory proposed that the price of innovation should always be below a price called "Threshold Price" above which the customers will not pay or purchase (Russel, 1980). Granovetter (1978) states that to sustain the adoption of innovation, a minimum number of people in the market should adopt innovation – the same as the critical mass concept proposed by Roger.

Arrow (1962) stated the influence of Firm size and Market Structure on adoption decisions. Bigger Firms have better resources to adopt innovations. Competition in the market is an incentive to adopt innovation – to outperform the competitors.

Kotler (1971) studied the adoption of innovative services and put across (1) Individual innovativeness (2) personal influences (3) innovation characteristics (4) opinion differences (5) cost (6) risk (7) credibility (8) social approval (9) relative advantage and (10) organizational innovativeness as the relevant variables affecting adoption.

Zaltman, Holbeck, and Duncan (1973) studied the influences of (1) one innovation on another (2) customization (3) reversibility and (4) realization of benefits on Innovation adoption. Higher reversibility causes greater resistance to change. Shorter duration for the realization of benefits enhances the adoption rates. The ability for customization also enhances the adoption rates.

Tanner (1974) studied the diffusion of vehicles in the US and proposed two variables affecting adoption (1) Per Capita Income and (2) Cost of Car usage.

Lilien (1980) studied the diffusion of photovoltaic in the US Market and proposed Government policies and regulations affects the adoption decisions (Nechully, Pokhriyal, and Thomas, 2018). Compliances with these policies and regulations are vital for survival in the market.

End users will be very reluctant to adopt technology – if they do not have opportunities to experience the benefits or if they do not see it. Yapa and Mayfield (1978) stressed the importance of "Availability of Technology" for hands-on with the innovation – to enhance adoption.

Ward (1967) and Roger and Rice (1980) proved that the Re-Invention efforts (Either from the end-user or Innovator) delay the adoption of innovation.

3.2.2 YEARS: 1981 – 1999

Diffusion scholars like Dimaggio and Powell (1983), Tolbert and Zucker (1983), Scott and Christensen (1995), Lindzey and Aronson (1985), Drazen and Leonardo (1997), Banerjee (1992), Boyd and Richerson (1985), Ellison and Drew (1991) and Haunschild and Miner (1997) have explained the importance of imitation in the process of adoption - imitation for want of legitimacy in a particular group or market. Isomorphism is another name for imitation. Social Contagion – The spread of behavior is due to the "Imitative tendency" of individuals. The spread of behavior in a network is called the Bandwagon Effect. The Imitation creates a

bandwagon effect. Imitation explains Herd behavior as well – Propensity to copy the successors.

Dervin's Sense-Making Theory (1983) and Wilson's Gap Analysis (1996) explain the importance of imparting relevant and reliable information to satisfy the requirements of the customers. The relevant information incites a favorable attitude towards innovation.

Exciting needs are needs which, when fulfilled, exceeds the customer expectations. Kano and Nobuhiku (1984) suggest that for an innovation to be successful – it needs to meet the exciting needs. Speed of adoption becomes faster if the customers are delighted by meeting the exciting needs.

Perceived Behavioral Control can be defined as the Self Confidence on the part of individuals to perform a certain act or acts in a particular context. Perceived Behavioral Control affects adoption decisions. The influence of perceived Behavioral Control on adoption decisions was studied in detail by scholars like Ajzen (1991) and Taylor and Todd (1995).

Hall and Hord (1987) proposed seven steps in his Concern Based Adoption Model to explain the process of adoption – (1) Awareness (2) Information (3) Personal (4) Management (5) Consequence (6) Collaboration (7) Re-focusing. The concerns are eliminated at every stage of adoption to process to the next stage. Kwon and Zmud (1987) proposed a Six stage model of change management – (1) Initiation (2) Adoption (3) Adaptation (4) Acceptance (5) Performance Satisfaction (6) Incorporation. One of the most important points emphasized by Kwon and Zmud is that the process stream of research has to be integrated with the factor stream of research to get a holistic perspective of adoption. Cooper and Zmud (1990) modified Kwon and Zmud's model by replacing the last two steps by (1) Routinization and (2) Infusion. Homer (1987) introduced the concept of "Feedback" loop to the process of adoption. Incorporating a feedback loop helps

to understand the pulse of the market. Hays (1996) posits that based on feedback, the innovator can enhance adoption by "Re-Invention of Usage and Features."

There are many studies regarding the classification of adopter sets during this period. Sharif and Ramanathan (1981) divides the market into four categories (1) Rejecters (2) Adopters (3) Disapprovers (4) Uncommitted. Mahajan, Miller, and Kerin (1984) divide the market into (1) Unaware (2) Prospect (3) Customer. Hahn (1994) divides the market into (1) Non-Triers (2) Triers (3) Post Trial Non-Repeaters (4) Post Trial Repeaters. Hong, Labe, and Bayus (1989) categorize the market into (1) Adoption Sales (2) Replacement Sales (3) Multiple Purchases.

Vessey (1991), in his Cognitive Theory, explains that there should be a match between "Expected" and "Actuals" for the adoption to take place. Otherwise, the adopter rejects the innovation. Logistics Model of Innovation Proposed by Bhargava, Kumar, and Mukerjee (1993) also consider the market as a network of cells – the same as that of Theory of Cellular Automata.

Resistance to Change is an important variable affecting adoption decisions. Ram (1987) has proposed "Model of Innovation Resistance" to study the influence of "Resistance to Change." He concluded that the variables, namely (1) Propagation Medium (2) Consumer Characteristics (3) Perceived Innovation Characteristics influences "Resistance to Chance."

Diffusion scholars like Wilson (1981), Deng (1982), Hauser and Wisnieuski (1982), Horsky and Simon (1983), Simon and Sebastian (1987), Soule and Strang (1998), Kalish (1985), Roling (1988), Nowak and May (1992), Steffen (1998) and Daft and Lengel (1986) have studied the influence of "Information" on the adoption decisions. Customer searches reliable sources for relevant information and keeps on doing that until they get sufficient information to choose a satisfactory solution. If information regarding a particular technology is not available, information regarding similar technologies is referred to make a decision. The market has to move from a state of "Unawareness" to "Awareness."

Advertisements play an important role in imparting information to the target market. Advertisement also enhances the inquisitiveness of the target market. For sophisticated technologies, the adoption will be a lengthy process. Today's market is very dynamic. Xie, Sirbu, and Song (1997) proposed the Augmented Kalman Filter to account for these changes in adoption models.

There are times when a "Sense of Urgency" needs to be created to enhance the adoption of innovation. Customers always tend to postpone or delay adoption decisions. Dixit, Dixit, and Pindyck (1994) made studies along these dimensions in "Real Options Framework."

Many of the models assume that the target market has an identical taste (which is a limitation) and the price/cost of innovation remains constant or decreases as the time progresses. The Rate of adoption increases as the market get more information. Relevant information regarding the innovation reduces or eliminates the uncertainties associated with the innovation. Appropriate communication channels have to be selected to impart relevant information. Information regarding the "new uses" stimulates re-purchases. Saha, Love, and Schwart (1994) posit that the information received by the prospects should be above a "Threshold level" for initiating the adoption.

The price/cost of innovation and affordability influences adoption decisions. Jeuland and Dolan (1981) state that the price of innovation should be lower than the "Reservation Price" – the maximum price innovator is ready to pay. Favorable word of mouth increases the Reservation Price. Liberman and Paroush (1982) posit that income and price determine the affordability of innovation. Thompson and Teng (1983) and later Feichtinger (1985) studied the effects of pricing strategies on adoption and concluded that "Skimming Strategy" is not advisable for innovation. At the introduction stage, the price has to be lower to attract customers. The innovator can increase the prices as or when the innovation establishes credibility. Chatterjee and Eliashberg (1990) established that innovation has to overcome the "Risk" and "Price" hurdles to get adopted in the

market. Jain and Rao (1990) and Golder and Tellis (1998) also proved that price and affordability influence adoption decisions. There are times when the customer will wait until the product becomes affordable. Kamukura and Balasubramanian (1988) and Goodwin and Fildes (1998) contradicted the findings of other diffusion scholars and established that price does not affect the adoption decisions. David (1990) and Mowery (1998) proved that the cost of adopting new technology – complementary investment for infrastructure, training, and procedural changes delays adoption decisions.

Lilien and Yoon (1990) argue that the opportunities for "Hands-on" with innovation eliminate the perception of uncertainties regarding product performance. Especially when Millions of dollars are involved – successful demonstration of a prototype enhances the scientific credibility of the innovation.

Availability of Substitutes for innovation retards the adoption rate. The influence of substitute was first studied by Srivastava, Leone, and Shocker (1981) by analyzing the diffusion patterns of Gas Stove vs. Electric Stoves. Bayus (1987) introduced the concept of "Contingent Innovation" – The adoption of one innovation influences the adoption of others. For example, the sales of cartridges depend on the sales of printers. Norton and Bass (1987), Mahajan, Wind, and Muller (2000) and Kim, Chang, and Shocker (2000) explained the influence of Inter-Category and Inter-Generational competition on adoption decisions. Inter-Generational and Inter-Category competition leads to "Replacement purchases." Gates (1998) proposed the concept of "Complementary Products Innovation." Adoption rates of complementary products reinforce each other. Application Software and Personal computers have mutually reinforcing effects.

Minsky (1986) and Brooks (1982) studied the influence of Hype Cycles on adoption. The end users overestimate the benefits, and this overestimation accelerates adoption for a brief period. When the end-user gets to know about the actual benefits, he spreads unfavorable opinion and retards adoption. Fashion and Seasonality also influence adoption decisions. "Theory of Management Fashion"

proposed by Abrahamson (1991) posits that the companies adopt innovations recommended by consultants, business or technical journals, business gurus, etc. Radas and Shugan (1998) proposed that the sale of some innovations increase during particular seasons of the year.

Farrel and Saloner (1985) proposed the concept of Network Externality. The benefits accrued to a customer are directly proportional to the number of adopters already using it. The best example of this is the mobile phone — the utility of mobile increases as the number of people using mobiles increases.

Horsky (1990) explains the concept of "Time Budgets." Innovation should be able to achieve a particular task in minimum time. Normally in the industry, most of the tasks have time budgets.

Lack of organizational readiness in terms of infrastructure, training, etc. delay adoption. Lacovou, Benbast, and Dexter (1995) emphasize the importance of organizational readiness in adoption decisions. In big companies – lack of readiness of partners retards adoption as pointed out by Zhu, Sarkis, and Kee-Hun (2008). The organization should be very careful while selecting innovation. The employees should have sufficient skill sets and motivation to utilize it. Scherer (1986) studied this concept in his "Matching Person and Technology Model." An end user will not be willing to utilize an innovation if it does not meet his specific job requirements. Goodhue and Thomson (1995) explained this concept in "Task-Technology Fit Model." TTF demands customization and compatibility. TTF proposes eight important factors influencing the adoption of innovations (1) Authorization (2) Quality (3) Compatibility (4) Locatability (5) System Reliability (6) Ease of Use (7) Product Timeliness (8) Relationship with the users.

The adoption of innovation will be slow if it is not in line with the Organizational Strategy. Gustafson (1986) studied the effects of Innovation – Organizational Strategy Fit. Organizational priorities change as per the market conditions, and Company policies have to change as per Organizational Priorities. The

“Relevance” of innovation to the firm depends on “Priorities” and “Policies” (Yates, 1989). Kuan and Chau (2001) state that Government regulations, Industry Standards, and Competition influence adoption decisions. Monopoly/Oligopoly markets have no incentive to innovate.

Diffusion scholars Tani (1988), Libertore and Bream (1997) and Tornatzky and Fleischer (1990) supported the fact that bigger companies can afford to have better infrastructure for adoption and adoption rates are faster with big companies. But Henderson and Clark (1990) contradict this, stating that adoption is slow in bigger companies due to the complex bureaucratic structure. Chong, Liu, and Raman (2009) emphasize the need for effective communication channels, management commitment, and support and Implementation strategy to speed up adoption in big firms. Visionary leadership at the top can create all the difference in the adoption process, as stated by Van De Van, Garud, and Venkataraman (1999).

Enhancing the absorptive capacity of firms can enhance the adoption of innovations. Scholars like Levinthal and Cohen (1990) and Keller and Forehand (1996) state that the ability to learn can be enhanced by training programs, properly defining the job roles and changing the organizational structure if required.

Bower and Christensen (1995) posit that “Management Myopia” leads to the downfall of an organization. Adoption of Innovation decreases productivity in the short run. Organizations have to make a lot of changes in the procedures, infrastructure, skillsets, etc. These changes create a temporary fall in productivity. But once the organization gets used to innovation, they will start reaping the benefits in the long run. Greenwood and Yorokolgu (1997) and Amara (1983) argued that companies should never abandon innovation by assessing the short term results.

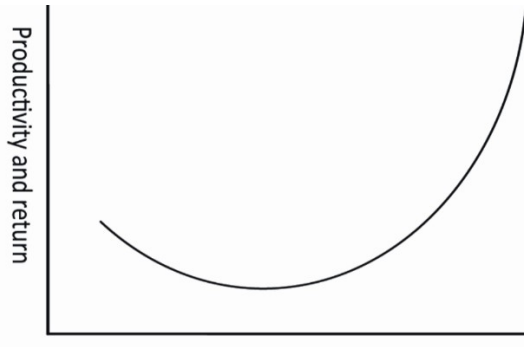


Figure 3. 2 Short Term Decline (adapted from Greenwood and Yorokolgu, 1997)

In many instances, the innovation is not sold directly to the end-users. Distribution channels can also play a significant role in adoption decisions. In many regions, where the innovator cannot establish its presence, the innovator has to work through the distributor. A well informed, motivated distributor with smart sales force can establish a very good relationship with the end-users. Ritz and Morgan (1991) studied the influence of distribution channels on the adoption decisions.

The period (1981 – 2000) witnessed the emergence of many Information System Adoption models. The first IS adoption model proposed by Davis, Bagozzi, and Warshaw (1989) was the Technology Acceptance Model (TAM). This basic version dealt with only two variables (1) Perceived Usefulness (2) Perceived Ease of Use

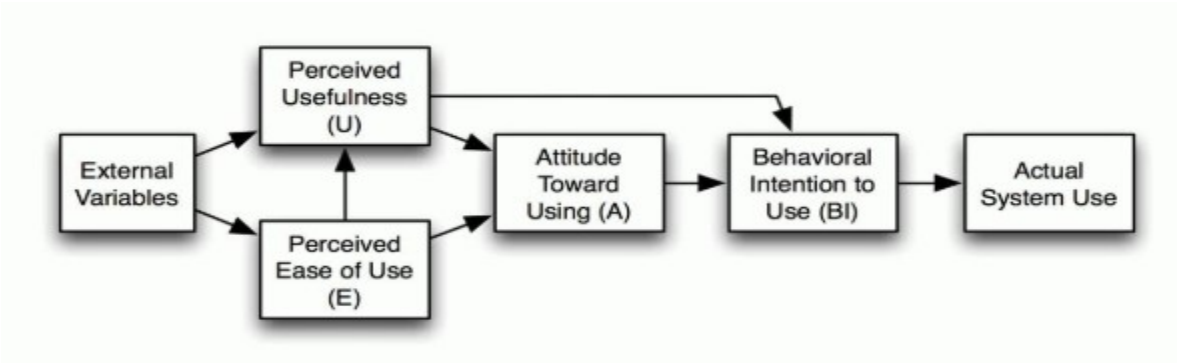


Figure 3. 3 Technology Acceptance Model (adapted from Davis, Bagozzi and Warshaw, 1989)

These two factors influence the attitude towards innovation. There are more than 150 extended or enriched versions of TAM. Davis (1989) pointed out that "Usefulness" has more influence on acceptance than "Ease of Use." Malhotra and Galletta (1999) added the dimension of Group Pressure/Social Factors to TAM. Thomson, Higgins, and Powell (1991) added the dimensions of (1) Long Term Consequences (2) Facilitating Conditions, (3) Complexity (4) Job Fit to TAM. Delone and Mclean (1992) added the dimensions of Quality – (1) Information Quality (2) Service Quality and (3) System Quality to the adoption literature. Taylor and Todd (1995) added the dimensions of Subjective Norms and Perceived Behavioral Control to TAM.

The variable – Employee Skills was added to TAM by Igbaria, Parasuraman, and Baroudi (1996) and later confirmed by Kennickell and Kwast (1997). Mahler and Roger (1999) confirmed the influence of the History of Purchases on adoption decisions. Dasgupta, Agarwal, and Gopalakrishnan (1999) enriched TAM by adding the variables Organizational culture, Size, Price, and Competition to the base model.

One of the main disadvantages of TAMs was that it deals only with the acceptance of technology by the end-users or employees of an organization. Scholars discarded Organizational Perspectives/Dimensions. Adoption Scholars should study the adoption process from organizational and individualistic perspectives to get a holistic perspective of technology adoption.

3.2.3 YEARS: 2000 – 2018

Wiefel (2002) categorizes the adopter set into (1) Technology Enthusiast (2) Visionary (3) Pragmatists (4) Conservatives (5) Skeptics. He also pointed out that there exists "Chasms" or "Gaps" between the adopter categories and the innovators need to close this gap to sustain diffusion. Mckeown and Barnett (2012) categorized the education market into (1) Leaders (2) Sharp ones (3) Wood

(4) Ferrules (5) Erasers. Bowling Pin Model proposed by Moore (2002) suggests finding the USP for different categories.

Consumer Innovativeness – the orientation of consumers towards innovation plays an important role in adoption decisions. Christia (2000) divides innovativeness into "General Consumer Innovativeness" and "Product Category Specific Innovativeness." The general consumer innovativeness needs to be converted to product category-specific innovativeness to initiate the adoption process.

Shane (2008) proposed the concept of "Innovation space" to explain the "Ideal Innovation." An Ideal innovation should have "Desirable," "Salable," and "Feasible" features. Without these three features, the consumer will abandon innovation.

Scholars like Puentedura (2006) and Keller and Suzuki (2014) have made contributions to the process stream of research. Puentedura (2006) divides the whole process of adoption into (1) Re-Definition (2) Modification (3) Augmentation (4) Substitution. Keller and Suzuki (2014) point out that the innovator should seek (1) Attention, then (2) Convince about the relevance (3) then build confidence (4) and ultimately substitute.

Leadership is an important variable affecting adoption decisions. Ngambi and Bozalck (2013) and Coakley and Randall (2007) emphasizes the need for transformational leadership in organizations. A company blessed with transformational leadership plans ahead for the challenges in the future. Transformational leadership, as the name suggests, transforms the companies to the next level of performance.

Opinion leaders/Technology Stewards and Pockets of innovation accelerate the adoption process in organizations. Scholars like Goldenberg, et al., (2001), Gladwell (2000), Hodas and Lehman (2014) and Wenger, White and Smith (2009) have studied the influence of (1) Opinion leaders and (2) Pockets of

Innovation. Opinion leaders/Technology stewards are respected authorities on particular technologies – who are often consulted to make adoption decisions. Pockets of innovation are certain people who would like to try out new things. So be it a network or organization, convincing these two groups enhances the adoption rates.

Dekimpe, Parker, and Sarvary (2000) emphasize the need for a "Central Decisions Maker" in a particular market to oversee the innovation activities. The presence of a "Central decision-maker" enhances adoption. Baker and Hunter (2002) posit that the Government Regulations have a significant influence on adoption decisions. Zhang, Yu, and Spil (2002), Fraj and Martinez (2006) and Silva, Lira, and Pereira (2011) state that the safety and environmental regulations made by the industry/government influences adoption decisions.

In an organization, there will always be two kinds of forces. Forces that can enhance the adoption and Forces that can retard the adoption of innovations. Forces favoring adoption should always be greater than forces against it. Myers and Oliver (2001) call these forces as (1) Provocation (Favoring) and (2) Repression (Against)

The level of customer involvement in the adoption decisions enhances the commitment from the customer to utilize it. Level of customer involvement also dispels the fear of failures. Brand loyalty retards innovation adoption from Non – Loyal brands. The influence of Customer involvement and Brand Loyalty were studied by Kaine, Beswell, and Linehan (2004), Lynch and Wood (2002) and May (2009).

Strang and Macy (2001), Wang and Li (2010) and Varian and Choi (2012) studied the influence of "Fashion" on adoption decisions. Performance entices Early adopters; Fashion entices middle Adopters and Legitimacy entices Late Adopters. Middle class and Lower Class always tend to follow the fashions of the upper-

class people. Adopting a particular innovation becomes a “status symbol” in the society or market.

Lehman and Weinberg (2000) emphasize the relevance of “Time Budgets” in adoption decisions. This study highlighted the quickness and convenience aspects of innovation. Schmidt and Porteus (2000) and Schmidt and Druehl (2005) studied the influence of Advertising/Word of mouth publicity on reservation price – Maximum price a customer is willing to pay for innovation. A favorable word of mouth can increase the reservation price. Parmentola, Simoni, and Tutore (2013) emphasized the need to have “Innovation Specific Policies” to enhance adoption.

There were many studies to enrich TAM during 2000 – 2018. Venkatesh and Davis (2000) added the variables (1) Result Demonstrability (2) Image (3) Job Relevance (4) Output quality (5) Voluntariness and (6) Experiences to the base TAM model proposed by Davis (1989). Parasuraman (2000) and Godae and Johansen (2012) state that Optimism and Innovativeness encourage innovation, whereas Insecurity and Discomfort discourage innovation adoption. Casalo, Flavian, and Guinaliv (2012) suggested that the personal values of the customers also influence the attitude towards innovation.

Davis et al., (2003) proposed four additional variables in his new model UTUAT – (1) Hedonic Motivation, (2) Value delivered (3) Habit (4) Facilitating Conditions. Hedonic Motivation refers to the motivation to undertake those activities which gives pleasure to the end-users. It was later proved by Lowry and Fienen (2000) that customers adopt innovations which gives them pleasure and reject innovations which give them bitter experiences.

The studies of Gruber and Verboven (2005) and Caselli and Coleman (2001) validated the importance of facilitating conditions like complimentary infrastructure and education levels. Godinho and Fagerberg (2003) and Black and Gregersen (2003) pointed out that facilitating conditions contributes to

organizational readiness. Lack of Preparedness of an organization can retard the adoption of innovation.

The Trust placed on the innovator by the end-users enhances adoption. Luque (2002) and Ruyters, Wetzel, and Kleijnen (2001) pointed out that (1) Reputation (2) Perceived Risk and (3) Relative advantage influence the trust placed on the innovator. Collan (2007) posits that human beings as such are very lazy and place importance on the "Effort required" for innovations. Efforts required can be along two dimensions (1) Efforts required to learn (2) Efforts required to operate. Carter and Belanger (2005) emphasized the importance of "compatibility angle" in adoption decisions. Sun, Neslin, and Srinivasan (2005) validated the innate human tendency to delay adoption based on future expectations of technology advancements or reduction in prices.

Aguiar and Reis (2008) did a detailed study on the "imitative tendencies" of organizations and concluded that there are three pressures which influence the imitative behaviors – (1) Pressure to imitate competitors (Mimetic Pressure) (2) Pressure to imitate the dependent organizations (Coercive pressure) (3) Pressure to comply with partners (Normative Pressure).

In today's world, most of the technologies require connection to the internet for hardware and software updates. Wang and Liu (2010) proved that "Security features" of the innovation influence adoption decisions.

Relationships of employees within an organization and the willingness of employees to help each other enhance the utilization of innovation. Sykes, Venkatesh, and Gosain (2009) pointed out that social ties enhance innovation adoption. Not all employees are smart enough to master the usage of innovation. So, the smart ones have to help the average ones to enhance the utilization of innovation.

Barton (2008) and Norris and Soloway (2011) proposed the concept of "co-adaptation" of innovation and organization. It is a process of mutual adjustments

– to put it in simple words. The innovator should make necessary changes to innovation to suit the organization, and the organizations need to implement the necessary procedural/process changes to adopt innovation.

The Innovator should not underestimate the influence of social networking sites, blogs, etc. on the adoption decisions. Clemon, Gao, and Hilt (2006) and Brown (2009) states that 89% of the customers go through online product reviews before making a purchase decision.

Armenakis et al. (2007) posit that an organization has to ask five important questions before finalizing on the innovation. (1) Should we change it? (2) Do we have a better choice? (3) Do we have the infrastructure to change? (4) Can we enlist the support of the innovator? (5) What are the benefits to the organization?

Arnholt and Balte (2003), Diederen, Meilj, and Wolters (2003) and Reichardt and Jurgen (2009) considers income/cost as the main hindrance/obstacle for innovation adoption. Paudel, Mishra, and Segarra (2011) attribute "Satisfaction with the current practices" as the main obstacle for change. Gelb and Voet (2009) point out the importance of "Aftersales support" from the innovator to enhance user satisfaction.

The preliminary review of theories and models of adoption resulted in 227 variables – out of which many of the variables are same/similar with different names. The variables with the same/similar meanings are either deleted or merged. Deletions or Merging of Variables results in 147 variables – the researcher will test the relevance of these variables concerning innovative technologies in upstream UAE Oil and Gas. The Researcher explains the process in the paper titled "Constructing a Conceptual Lens/Preliminary Framework for Further Testing in Upstream Oil and Gas" – placed in Appendix F.

3.3 CHAPTER CONCLUSION

Literature Review is done to build a strong theoretical foundation for the research. It helps to identify the appropriate theory (or theories) for research and the theoretical gaps in the existing theories and models. It also helps to correlate the findings to the existing theories at a later stage of the research.

CHAPTER 4

SELECTING THE THEORETICAL UNDERPINNING AND THEORETICAL GAP

4.1 INTRODUCTION

Having a base theory or theories adds authenticity to research work. Theoretical underpinning(s) helps the researcher to come up with a research plan. Theoretical underpinning helps the researcher to relate his work to the existing body of research and theories and to describe how the work contributes to the field of study. It helps to communicate the relevance of the work to the research community (Cresswell, 1998).

4.2 THEORETICAL UNDERPINNING

Organizations need to benefit from innovations. Innovation has to be utilized by the employees for reaping benefits. The Researcher has to study the process of adoption from the perspectives of "Adoption by Organization" and "Utilization by its employees." Frambach and Schilleweart (2002) model of adoption explains the two dimensions of adoption – (1) Adoption by organization, (2) Utilization by the employees.

4.3 THEORETICAL GAP

The limitation of Frambach and Schilleweart model is that the variables affecting the "Pre-Adoption" stage are not mentioned or studied. To enhance the process of adoption of innovation, the organization has to move from the Pre-Adoption stage to Adoption and then to Post Adoption. It should not get stuck up in any particular stage as the adoption process has to be cyclic. The influence of Pre-Adoption variables on the process of adoption is the theoretical gap.

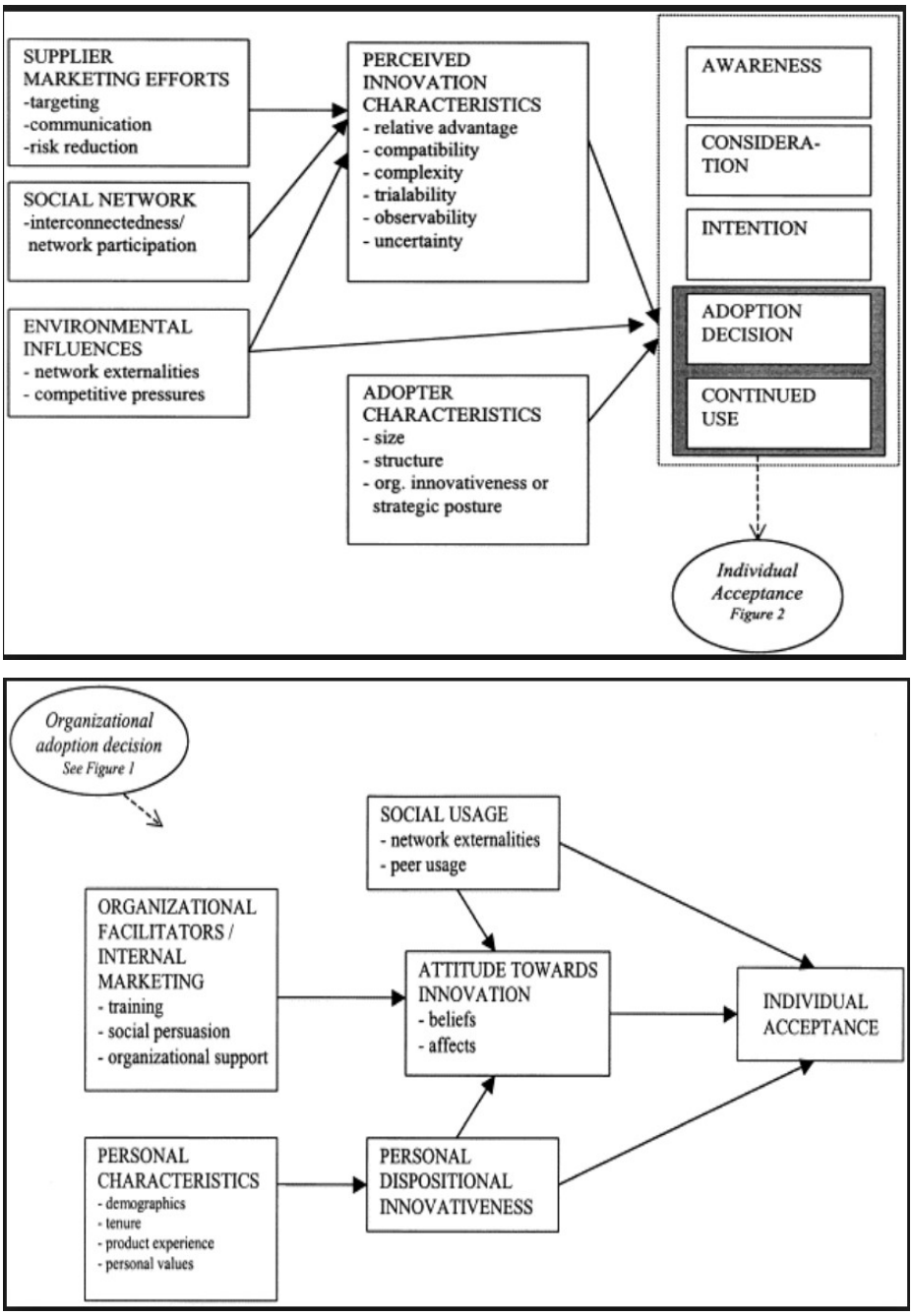


Figure 4. 1 Frambach and Schillewaert Model (adapted from Frambach and Schilleweart, 2002)

4.4 CHAPTER CONCLUSION

Selection of a Relevant Theory to be used as the Base Theory and Identification of the Theoretical Gaps – helps to integrate the industry/practical and theoretical aspects – gives a proper direction of study to the researcher. At the later stages of the research, the Researcher aligns the theoretical gap with the Research Problem/Questions/Objectives.

CHAPTER 5

STATING BUSINESS PROBLEM, RESEARCH GAPS, RESEARCH PROBLEM, RESEARCH QUESTIONS, AND RESEARCH OBJECTIVES

5.1 INTRODUCTION

The Researcher explains the process of arriving at the Research Gaps, Research Problem, Research Questions, and Research Objectives in the paper titled "Systematically Arriving at the Research Topic for Study in Oil and Gas" – placed in Appendix D. The Theoretical Gap identified during the Literature review is aligned with the Research Problem, Research Questions, and Research Objectives. The Researcher identified the Business Problem from Relevant Oil, and Gas Articles and Reports, and the Research Gaps from the Relevant Research Papers. The Researcher identifies the Recurring themes from the Articles and Reports and Theme wise Research papers are identified and reviewed for Research Gaps.

5.2 REFINING AND RE-STATING THE BUSINESS PROBLEM

"Pace of adoption of innovative drilling technologies is slow in Upstream UAE Oil and Gas sector thereby incurring losses to Oil & Gas companies – delayed or missed opportunities for cost savings and profitability."

5.3 THEMES EMERGED OUT OF LITERATURE REVIEW

The themes that emerged out of the literature survey were as follows.

(1) UAE Oil & Gas Sector.
(2) UAE Government Initiatives on Innovation
(3) Significance of Innovative Technologies in UAE Oil & Gas
(4) The slow pace of technology adoption in UAE Oil & Gas

(5) Impact of Non/Slow adoption of Innovative Technologies

(6) Marketing/Sales Strategies of Innovator

5.4 FUNNELLING OF RESEARCH GAPS – THEME WISE

Table 5. 1 Funneling of Gaps

S No	Themes	Research Gaps	Consolidated Research Gaps
1	UAE Oil & Gas Sector	The challenges to innovation not mentioned	
		How Vat affects the purchase of products not explained	
		Strategies to promote innovation not mentioned	
		Determinants affecting the adoption of Innovation not mentioned	
		How business confidence affects the adoption of innovation not mentioned	
		The Impact of Govt. Policy on the adoption of innovation not studied	
		The impact of the prequalification process on the adoption of innovation not studied	
2	UAE Government National Strategy & Incentives on Innovation	Lack of focus on O&G Sector	
		The relevance of Innovation in the O&G sector not mentioned	
		Determinants affecting the adoption of Innovation not mentioned	
		Strategies to promote innovation not mentioned	
		Impact of National strategy on O&G not studied	
3	Innovative Technologies & its importance in UAE O&G	Determinants affecting the adoption of innovation not explained except three determinants.	
		Strategies to enhance adoption not explained	
		Impact of National strategy on O&G not studied	
		A common platform to discuss O&G sector innovation not there in UAE	**1. Adoption enablers not identified concerning UAE Oil & Gas**
4	Impact of Non/Slow adoption of innovative technologies in UAE O&G	Strategies to enhance adoption of innovation not discussed.	**2. Framework for the adoption of innovative technologies not proposed UAE Oil & Gas**
		Determinants affect the adoption of innovation not discussed.	
		A Framework or model for adoption not specified	
		Criticality & Interdependence of the determinants is not found out	
5	The pace of Technology adoption in UAE O&G	The reason stated for Nonadoption/Slow adoption is only "complacency" and "lack of time."	
		Strategies to enhance adoption of innovation not discussed.	
		Determinants affect the adoption of innovation not discussed.	
		A Framework or model for adoption not specified	
		Impact of National Innovation Strategy on Technology adoption not investigated.	
6	Marketing & Sales Strategies for Innovation in UAE O&G	Determinants affect the adoption of innovation not discussed.	
		Strategies to enhance adoption of innovation not discussed.	
		Framework or model for adoption not specified	
		The impact of Operator engagement/involvement not studied in the context of the UAE to enhance adoption	

		Many of the discussions are from a "Marketer" point of view. The determinants not checked from an end-user point of view. Views collected from Marketers, not end-users	
		Impact of partnership on adoption not studied in the context of UAE	
		"Risk" to be tested as a determinant of adoption in UAE O&G	
		Studies regarding strategies not in the context of UAE O&G	
		The impact of personal selling on adoption not carried out in the context of UAE	
		The impact of Internet marketing/Social media on adoption not carried out in the context of UAE	

5.5 COMBINED & CONSOLIDATED RESEARCH GAPS

(1) Adoption Variables not identified concerning the adoption of innovative drilling technologies in Upstream UAE Oil & Gas.

(2) A Framework/Model for the adoption of innovative drilling technologies not found concerning Upstream UAE Oil and Gas.

Aligning the Theoretical Gap with Research problem, the researcher finalizes and summarizes the Research Problem, Research Questions, and Research Objectives as follows:

5.6 RESEARCH PROBLEM

1. The Researcher formulates the Research Problem as: “What is the role of adoption variables/enablers (with special emphasis to Pre-adoption variables/enablers”) to enhance the adoption of innovative drilling technologies in Upstream UAE Oil & Gas?”

5.7 RESEARCH QUESTIONS

(1) What are the different enablers/variables that can enhance the adoption of innovative drilling technologies in Upstream UAE Oil & Gas?

(2) What should be a Framework (covering the entire gamut of Technology adoption with special emphasis to Pre-adoption) to facilitate/enhance the adoption of innovative drilling technologies in Upstream UAE Oil & Gas?

5.8 RESEARCH OBJECTIVES (RO1 & RO2)

(1) To find out the different enablers/variables that can enhance the adoption of innovative drilling technologies in Upstream UAE Oil & Gas.

(2) To propose a Framework (covering the entire gamut of Technology adoption with special emphasis to Pre-adoption) to facilitate/enhance the adoption of innovative drilling technologies in Upstream UAE Oil & Gas.

5.9 CHAPTER CONCLUSION

The Researcher finalizes the Business Problem, Research Problem, Research Gaps, Research Questions, and Research Objectives. Finalization of Research Questions and Objectives gives clarity regarding the direction of the research. The precise "Scope of Research" is also defined. The Scope of Research describes the – "Dos" and "Do Not" of the researcher.

CHAPTER 6

RESEARCH DESIGN

6.1 INTRODUCTION

The Researcher has already written a paper on the Selection of Appropriate Qualitative Research Methods for Study in the Paper Titled "Choosing Grounded Theory and Framework Analysis as the Appropriate Qualitative Methods for the Research" – in Appendix E. Qualitative studies answer the Why and How of the phenomenon under study. Research Design describes how to conduct the research. Research Design describes the appropriate methodology for answering the research question. Research Design furnishes details about the Problem Statement, Data Collection Techniques, Data Analysis Methods, and Tools, Research Settings, and Timelines.

6.2 JUSTIFICATION FOR SELECTING ABU DHABI AS THE PLACE OF STUDY AND RESPONDENTS FROM UPSTREAM ADNOC GROUP OF COMPANIES

Abu Dhabi dominates the UAE Oil and Gas market with 96% of Oil and 94% of Gas reserves. The remaining emirates contribute only 4% and 6% of Oil and Gas reserves respectively. Abu Dhabi National Oil Company (ADNOC) operates 16 companies and oversee the exploration, production, storage, refining, distribution, and development of a wide range of petrochemical products. Since Abu Dhabi dominates UAE market, ADNOC is the driving force in UAE Oil and Gas, and SPC is the authority for formulating Oil and Gas policy, a study of Upstream ADNOC group of companies at Abu Dhabi gives the researcher the "Pulse of Upstream UAE Oil & Gas." ADNOC End users constitute the population of the study.

6.3 RESEARCH DESIGN FOR RO1

For Research Objective 1 – The various variables/enablers affecting the adoption of innovation are isolated by Literature review and variables/enablers relevant to adoption of innovative drilling technologies in Upstream UAE Oil and Gas are identified by Grounded Theory. Interview Transcripts will be analyzed using NVIVO 12. For Interviews, the Researcher uses Judgment Sampling and Snowball sampling techniques. Semi-Structured interviews will be conducted to collect data as it provides the flexibility to the researcher to ask extra questions if required or to re-phrase the questions according to the situation.

6.4 RESEARCH DESIGN FOR RO2

Research Objective 2 – The Framework will be done by "Framework Analysis." The Researcher follows the Research design proposed by Ritchie and Spencer (1994). One of the advantages of Framework analysis is three levels of validations. Interview Transcripts will be analyzed using NVIVO 12. For Interviews, the Researcher uses Judgment Sampling and Snowball sampling techniques. Semi-Structured interviews will be conducted to collect data as it provides the flexibility to the researcher to ask extra questions if required or to re-phrase the questions according to the situation.

6.5 QUALIFYING RESPONDENTS FOR INTERVIEW AND SELECTING THE APPROPRIATE SAMPLE SIZE

The respondents whose designation are Senior Engineer or above will be selected (More than 20 Years of Experience) – Senior Engineers/Consultants/Team leaders/Managers will be selected.

For qualitative studies, Patton (2002) suggests that the best sample size depends on time allocated, resource availability, study objectives, and ease of access. Creswell (2003) recommends 5 to 25 and Morse (1998) at least 6. Glaser and Strauss (1967) suggest to follow the "Principle of saturation" to determine the sample size for qualitative study – that is, saturation occurs when adding one

more respondent will not contribute any further dimension or information for the study.

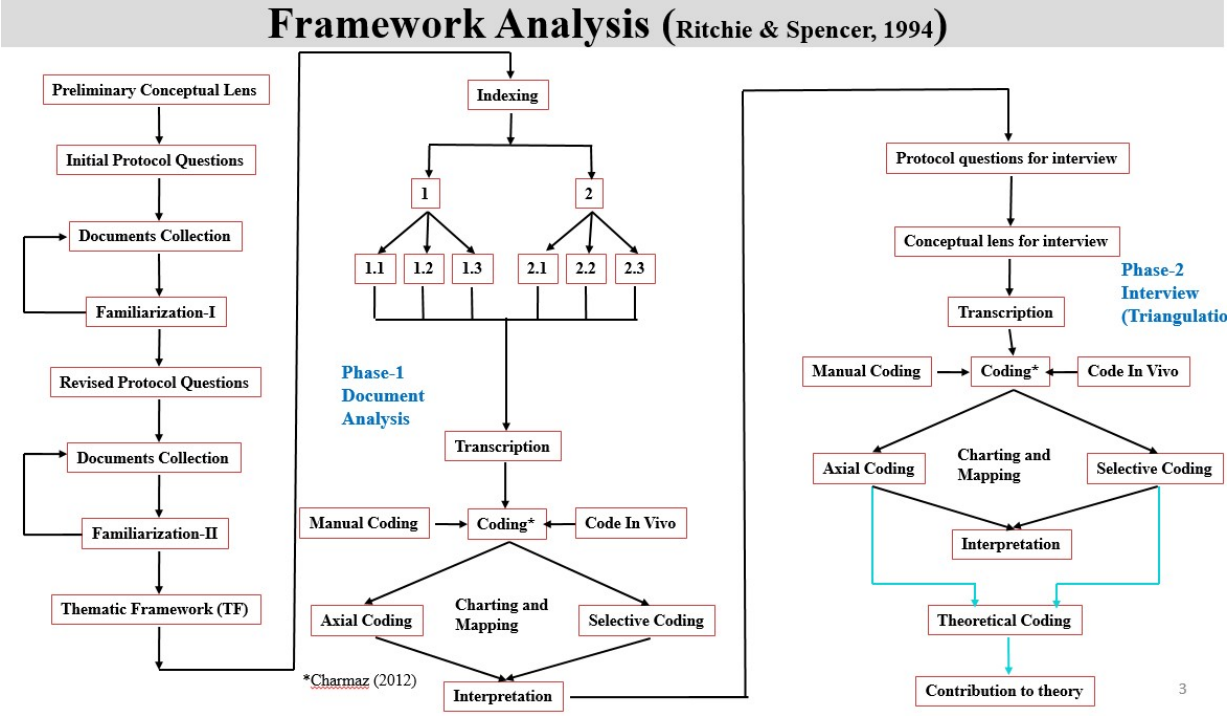


Figure 6. 1 Framework Analysis (adapted from Ritchie and Spencer, 1994)

Malterud, Siersma, and Guassora (2015) proposed the concept of "Information power" to determine the sample size for a qualitative study. Information power indicates that "the more information the sample holds, relevant for study, the lower amount of participation is needed." Sample size with sufficient information depends on (1) aim of study (2) quality of dialogue (3) sample specificity (4) analysis strategy. Guest, Bunce, and Johnson (2006) suggest that saturation often occurs in a homogenous group around 12 participants. Latham (2003) states around 15 participants – the saturation occurs. Crouch & McKenzie (2006) proposes that the "Sweet Spot" for qualitative research is 15 to 20 homogenous participants. The Researcher decides on a sample size of 15 for Qualitative analysis

6.6 SELECTING GROUNDED THEORY AND FRAMEWORK ANALYSIS AS THE METHODS OF RESEARCH.

6.6.1 GROUNDED THEORY

Grounded Theory helps to generate theory from the qualitative data collected and analyzed systematically. As the name suggests, the theory is grounded in the data collected. Grounded Theory can unveil the patterns of relationships hidden in the transcripts/data. Codes are labels or paraphrases used to high light the relevant portions of the transcript.

The process of coding starts with "Open coding." The researcher reads the transcript or data line by line several times and comes up with the initial codes. These codes are further analyzed for patterns of relationships and merged to form "Categories of Codes." This process is called Axial coding. These categories of codes are further connected to a "Core category" by the process called Selective coding.

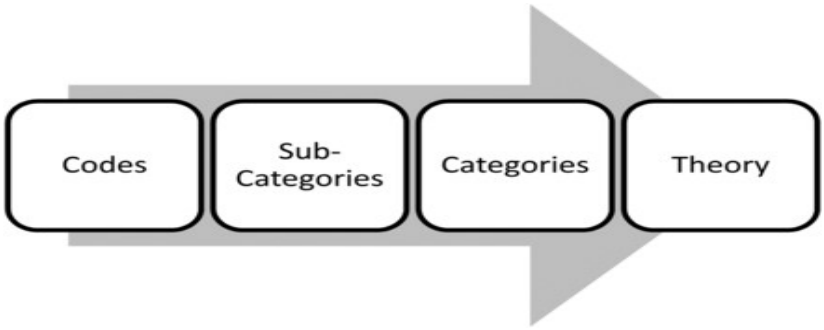


Figure 6. 2 Grounded Theory Data Analysis (adapted from Strauss and Corbin, 2016)

Glaser's Version of Grounded Theory proposes to keep an open approach for data analysis. Glaser' Version does not use Existing theories or Pre-Defined Theories. The codes should emerge from the data collected – proposes an Inductive approach for analysis. Strauss and Corbin propose a Deductive approach – where the existing studies and theories can be used to generate pre-defined codes or conceptual lens for data analysis. In this study, the researcher follows Strauss,

and Corbin's version of Grounded Theory as Glaser's version is very time-consuming. Initial findings or inferences can be further tested or validated in Grounded Theory. As the data analysis progresses, the researcher will get an idea as to where the relevant information is to searched to support or refute the findings. This process is called Theoretical Sampling. The interview protocol can be modified as the analysis progresses. The researcher should be able to generate useful insights from the data collected. The process of generating useful insights is called Theoretical Sensitivity. Theoretical Sensitivity depends on Experience and Expertise of the researcher.

6.6.2 FRAMEWORK ANALYSIS

Framework Analysis provides a "Systematic Approach" to qualitative data analysis. Framework Analysis helps to reduce or summarize interview transcripts to rows and columns of Framework matrix. It saves times and efforts of the researcher by providing only the relevant portions of the text for further analysis. The charted data from various respondents can be compared and contrasted for getting an in-depth understanding of the phenomenon/problem under study. Framework analysis provides a systematic review of different perspectives from the respondents. The Researcher can analyze the patterns of underlying relationships from the row and columns of the matrix. Framework analysis leaves an "audit trail" from the initial framework to final interpretations.

Steps Involved in Framework Analysis.

1. Transcription: The Researcher prepares the interview transcripts for analysis. If the researcher is going for manual analysis, there should be sufficient space or margin on both sides of the transcript to code or to make important remarks/observations.

2. Interview Transcript Familiarization: The researcher goes through the interview transcripts, again and again, to get thoroughly familiarized with it. The Researcher notes the Important observations/insights on both margins of the transcripts.

3. Coding: If the researcher is employing a deductive approach of analysis, the predefined codes from the existing theories and studies are applied. If the researcher is employing an inductive approach, the codes emerge from the transcripts. The process of coding explained earlier for Grounded Theory is followed for Framework analysis as well.

4. Creating a Preliminary Analytical Framework / Conceptual Lens: The coding of the initial transcripts helps the researcher to draft a Preliminary Framework / Conceptual Lens. In purely deductive studies, the Researcher creates the Preliminary Framework from the existing theories and studies by combining the Factor Stream and Process Stream of Research.

5. Application of the Preliminary Analytical Framework / Conceptual Lens: The Researcher applies Preliminary Analytical Framework or Conceptual Lens to subsequent transcripts, and repeats the process of coding. The initial framework gets tested or validated in different stages of analysis. In Ritchie and Spencer's Version of Framework Analysis – the Preliminary Framework / Conceptual Lens gets modified or validated at four stages of data analysis – Two stages of Documents analysis followed by two stages of Grounded Theory. New codes or Relationships may emerge, and existing codes or relationship gets modified or deleted.

6. Charting the data into Rows and Columns of the Framework Matrix: At each stage of Framework Analysis – the relevant portions of the transcripts are taken into the Rows and Columns of Framework Matrix for easy analysis - Comparing and contrasting the concepts within and between the transcripts.

7. Interpreting the data: The Final Framework from the Fourth and Final Stage of data analysis can be used to answer the Research Problem. The Researcher draws

Inferences or Insights about the problem/phenomenon under study from the Framework or the charted data. The study of diverse perspectives from the respondents helps the researcher to tackle the research problem from different angles.

As described earlier, the Research Methods involved in the Framework Analysis are nothing but Document Analysis and Grounded Theory - Two stages of Documents analysis followed by two stages of Interview analysis using Grounded Theory. The Researcher has explained the Grounded Theory in the above paragraphs. The Researcher explains the Document Analysis in the subsequent paragraphs.

Document Analysis is a qualitative method for systematically reviewing the documents to answer the research questions. The coding techniques used for document analysis is the same as that of Grounded Theory. Document analysis is used to analyze three types of documents, namely (1) Public Records (2) Physical Evidence (3) Personal Documents. Before starting the document analysis, the researcher should have a "Proper Document Management Plan." Document Analysis gives multiple perspectives from different documents for the same question. It is up to the researcher to accept or reject these dimensions for final analysis. The Researcher indexes these perspectives and takes the best answer or appropriate answers to the transcript for further analysis. The steps involved in Document Analysis are as follows:

1. Collect the relevant documents
2. Develop a "Proper Document Management Plan"
3. Photo Copy the Documents for coding/ or import documents to software for coding and analysis
4. Ensure the Document authenticity, purpose, target audience and biases
5. Interview/Explore the documents for appropriate answers
6. Select the best/appropriate answers to the final transcript for analysis.
7. Draw Inferences.

6.7 CHAPTER CONCLUSION

Drafting Research Design gives clarity to the Researcher for contacting the respondents, selecting data collection techniques, analysis methods and tools, and presentation of findings – provides a Road Map for doing Research.

CHAPTER 7

THE RESEARCH FLOW

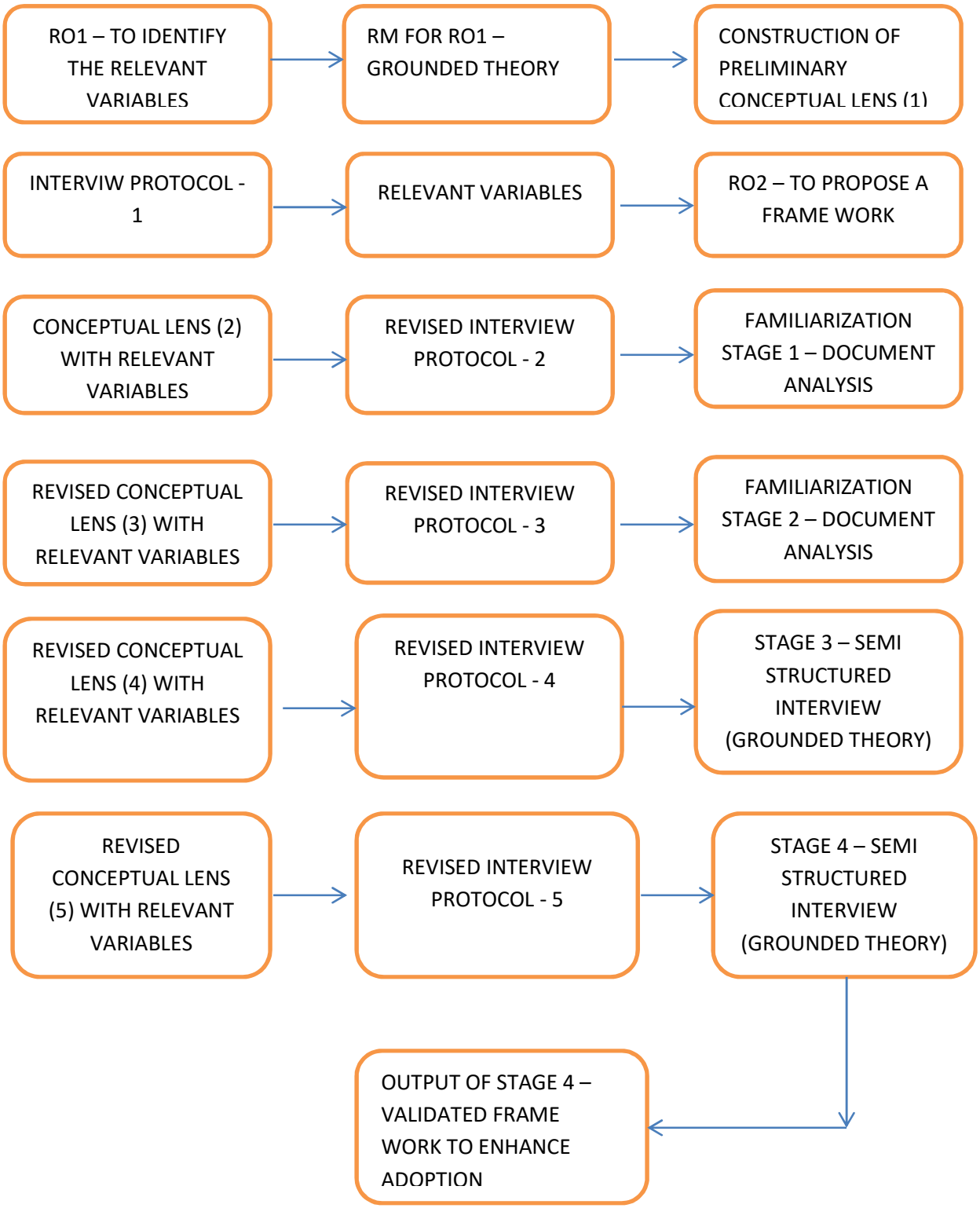


Figure 7. 1 Research Flow

7.1 RESEARCH FLOW

Research Flow diagram helps the researcher to present their research/findings in an orderly manner. A flow chart can be used to map the "Research Journey" from "Research Problem" to "Conclusion." Qualitative Research is all about getting information from the respondents about their particular experience(s) or how they feel about a particular phenomenon or research problem or scenario. The Researcher mitigates the element of subjectivity in the qualitative data analysis by using the Research Flow Diagram.

7.1.1 STAGE 1 – FOR RESEARCH OBJECTIVE 1

The justification for selecting qualitative approach for research and the reasons for selecting Grounded theory and Framework analysis are explained in the published paper titled – "Choosing Grounded Theory and Framework Analysis as the Appropriate Qualitative Methods for the Research" – placed in the Appendix E. The output of Research Objective – 1 goes as an input to Research Objective - 2. The Researcher has used Strauss and Corbin's (1990) Version of grounded theory. Strauss and Corbin's version of Grounded Theory proposes to use a Conceptual Lens as the starting point for Qualitative Analysis. The Researcher explains the construction of Conceptual Lens in the published paper titled – "Constructing a Conceptual Lens/Preliminary Framework for Further Testing in Upstream Oil and Gas" – placed in the Appendix F. The conceptual lens helps to focus the study along particular directions to answer the research question(s). The Researcher drafts the Questions for data collection from Conceptual Lens.

The Researcher constructs the Preliminary Conceptual Lens (1) for RO1. The Researcher drafts the interview protocol for RO1. The Researcher explains the process of coding of interview transcripts in the published paper titled – "Constructing a Conceptual Lens/Preliminary Framework for Further Testing in

Upstream Oil and Gas" – placed in Appendix F. The output of RO1 goes as an input to RO2.

7.1.2 STAGE 2 – FOR RESEARCH OBJECTIVE 2

Framework Analysis has got four stages. First, two stages are Familiarization Stages using Document analysis method followed by the last two stages of analysis using the Grounded theory method. The output Framework from each stage of analysis becomes the conceptual lens for the subsequent stage. The interview protocol is also revised accordingly.

The output of RO1 becomes the Conceptual Lens (2) for the First Stage of Familiarization in the Framework Analysis. The Researcher revises the Interview protocol according to the Conceptual Lens (2) to Revised Interview Protocol (2). The output of the First stage of Familiarization becomes the Conceptual Lens (3) for the Second Stage of Familiarization. The interview protocol is changed accordingly to the Revised Interview Protocol (3). The Output Framework of the second stage goes as Conceptual Lens (4) to the third stage of Interview/Grounded Theory. The Researcher amends the interview protocol in line with the conceptual lens to Revised Interview Protocol (4). The Output Frame Work of the third stage goes as Conceptual lens (5) to the fourth and final stage of analysis - Interview/Grounded Theory. The interview protocol is also amended to reflect the changes in the conceptual lens if any - Revised Interview Protocol (4). The Framework that emerges out of the fourth and final stage of Framework Analysis is the "Validated Framework" – solution to RO2.

During the first two Familiarization Stages using Document Analysis method – Various documents are downloaded and categorized as per the Interview protocol. On an average – a minimum of 4 documents was referred per question. There will be different answers to the same question. The Researcher indexes different answers and selects the best answers to make the transcript. This transcript is

taken to NVIVO for further analysis. The term “Interview Protocol” is misleading in the context of document analysis. The researcher “interviews” – meaning searches various documents to get answers for the questions same like interviewing respondents for answers.

7.2 CHAPTER CONCLUSION

The Researcher charts the Research Journey into different phases. The Research flow diagram helps the researcher to set timelines phase-wise – it helps the researcher to set up milestones phase-wise to complete the research. Research Flow Diagram helps the researcher to plan the research.

CHAPTER 8

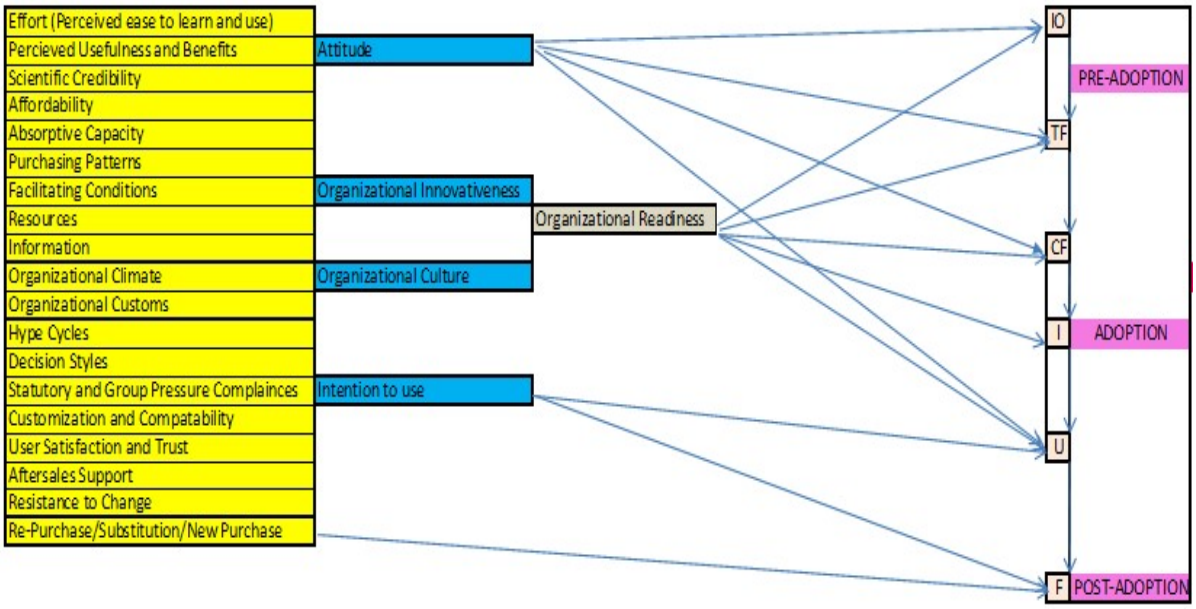
FINDING THE RELEVANT VARIABLES USING GROUNDED THEORY

8.1 INTRODUCTION

The Researcher uses Strauss and Corbin's (1998) version of Grounded theory for RO1 – suggests using a conceptual lens for data analysis. The conceptual lens (CONCEPTUAL LENS -1) already framed is used to draft the interview protocol (INTERVIEW PROTOCOL – 1). The Researcher furnishes the detailed data analysis in the paper titled "Identifying the Relevant Variables Affecting the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas" – placed in Appendix G

8.2 CONCEPTUAL LENS – 1 FOR RO1

The Researcher has already furnished the process of developing a Conceptual Lens in the paper titled "Constructing a Conceptual Lens/Preliminary Framework for Further Testing in Upstream Oil and Gas" – in Appendix F. As mentioned earlier – the data analysis starts with 147 variables identified from the Literature review, and the researcher will narrow down on the relevant variables after the data analysis. Only the Relevant Variables go to the further stages of data analysis.


Effort (Perceived ease to learn and use)
Percieved Usefulness and Benefits
Scientific Credibility
Affordability
Absorptive Capacity
Purchasing Patterns
Facilitating Conditions
Resources
Information
Organizational Climate
Organizational Customs
Hype Cycles
Decision Styles
Statutory and Group Pressure Complainces
Customization and Compatability
User Satisfaction and Trust
Aftersales Support
Resistance to Change
Re-Purchase/Substitution/New Purchase
Attitude
Organizational Innovativeness
Organizational Culture
Intention to use
Organizational Readiness
IO
TF
CF
I
U
F
PRE-ADOPTION
ADOPTION
POST-ADOPTION

S No	Variables/Factors	
1	Fashion	
2	Optimism	Hype Cycles
3	Seasonality	
4	Uncertainty	
5	Self Efficacy	Resistance to Change
6	Risk	
7	Satisfaction with Old Practices	
8	Fear of Change	
9	Sources of Information	Information
10	Aftersales Service	
11	Training	Aftersales Support
12	History of Past purchases	
13	Frequency of Past Behavior	
14	Familiarity	Purchasing Patterns
15	Habit	
16	Ease of Use	
17	Ease to learn	Efforts
18	Complexity	
19	Beliefs of outcome	
20	Evaluation of outcome	
21	User Experience	User Satisfaction and Trust
22	User Satisfaction	
23	Production Timeliness	
24	CEO Innovativeness	
25	Individual Innovativeness	
26	Market Structure	
27	Market Competition	
28	R&D	Absorptive capacity
29	Organizational Openness	
30	Interorganizational Dependence	
31	Willingness	
32	Curiosity	

33	Switching Cost	
34	Income	
35	Cost of adoption	Affordability
36	Prevailing Wage Rates	
37	Budget allocation	
38	Price	
39	Cost Savings	
40	Profitability	
41	Environmental Benefits	
42	Long term consequences	
43	Security	
44	Convenience	Perceived Usefulness and Benefits
45	Perceived Innovation Characteristics	
46	Safety	
47	Time Budget	
48	Market Potential	
49	Enhanced Job Performance	
50	Relative Advantage	
51	Economies of Scale	
52	Knowledge of Technology	
53	Complimentary Infrastructure	
54	Government Support	
55	Managerial Skills	
56	Relationship	
57	General Economic Conditions	
58	Credit Availability	
59	Innovator Support	Facilitating Conditions
60	Licensing	
61	Technology Steward	
62	Innovation policy	
63	Leadership	
64	Management Support	
65	Organizational Strategies	
66	Organizational Priorities	

67	Management Commitment	
68	Higher Resale Price	
69	Last ditch effort	
70	Intergenerational Competitions	
71	Objectives	
72	Reversibility	
73	Technological advances	Re-Purchase/Substitution/New Purchase
74	Speed of Organizational Changes	
75	Alternatives	
76	Brand Loyalty	
77	Marketing Strategies	
78	Re-Invention	
79	User Skills	
80	High Education Levels	Resources
81	Distribution Channel	
82	System Reliability	
83	Quality of Results	
84	Visibility	
85	Product Features	Scientific Credibility
86	Prototype	
87	Demonstration	
88	Quality	
89	Performance	
90	Reference Group	
91	Government Regulation	
92	Number of Adopters	
93	Social Pressure	
94	Image enhancement	Statutory and Group Pressure Compliances
95	Central Decision Maker	
96	Imitation	
97	Trading Partner Power	
98	Network Membership	
99	Social Approval/Influence	
100	Standards	

101	Compatibility	
102	Fit to Work Settings	
103	Local Adaptations	Customization and Compatibility
104	Cross functional teams	
105	Job Characteristics	
106	Work group characteristics	
107	Authority	Organizational Climate
108	Job Tenure	
109	Job Roles	
110	Working Environment	
111	Norms	
112	Personal Influences	
113	Routines	Organizational Customs
114	Normative beliefs	
115	Subjective Norms	
116	Personal Values	
117	Organization Structure	
118	Age	
119	Communication Channels	
120	End User Involvement	Decision Styles
121	Motivation	
122	Voluntariness	
123	Company Size	

Figure 8. 1 Conceptual Lens

8.2.1 INTERVIEW PROTOCOL FOR RO1

The Researcher drafts the INTERVIEW PROTOCOL – 1 from the PRELIMINARY CONCEPTUAL LENS – 1. Based on the initial responses, the Researcher revises the difficult questions for a better understanding of the respondents. The first question is asked to get the general pulse of the UAE Oil, and Gas market and Questions 2, 3, and four are asked to validate the process of adoption. The process gets validated in the first stage itself.

1. Can you please tell me something about the Oil and Gas scenario in UAE now?
2. Can you please tell me something about the buying of new technologies in UAE Oil and Gas?

3. Can you please explain in detail – the buying process of innovative technologies – before adoption, adoption, and post-adoption stages in your organization?
4. Do you think the Identifying Innovation opportunity and Technology finalization constitutes Pre-adoption, Contract finalization, implementation, and utilization constitutes adoption, and ultimately, the future technology usage decisions constitute the post-adoption decisions?
5. Do you think the general attitude and readiness of an organization motivate you to search for an innovation opportunity in your organization?
6. Do you think innovativeness of an organization and organizational culture affect the readiness of an organization?
7. Do you think the general attitude and readiness of an organization affect the technology finalization in your organization?
8. Do you think the readiness of an organization and attitude affect contract finalization?
9. Do you think the readiness of an organization affects the implementation of innovative technologies in an organization?
10. Do you think attitude affects the implementation of Innovative technologies in an organization?
11. Do you think the general attitude, organizational readiness, and intention to use affect the utilization of innovation in your organization?
12. Do you think the intention to use and the decision to repurchase/substitution/new purchase affect the future usage of innovative technologies in your organization?
13. Do you think the variables like Ease of identification and usage, Affordability, Usefulness, and Scientific credibility leads to a favorable attitude for problem-solving?
14. Do you think the variables like absorptive capacity, patterns of purchase, facilitating conditions, resources, and information affect organizational innovativeness?

15. Do you think organizational climate and customs affect organizational culture?
16. Do you think hype cycles, decision types, various compliances, customization and compatibility, satisfaction, aftersales support, and resistance to change affect intention to use innovative technology in your organization?
17. Can you please tell me whether Inter-generational competition, alternatives, technological advances, reversibility, last-ditch efforts of the innovator, Re-Invention, etc. affect the substitution/re-purchase/new purchase decisions
18. Do you think Higher resale price, Objectives, Intergenerational competition, Speed of organizational changes, brand loyalty, reorganizing, and marketing strategies of innovator affect the substitution/re-purchase/new purchase decisions?
19. Do you think Fashion, Seasonality, etc. affect hype cycles?
20. Do you think optimism affects the hype cycles?
21. Can you please tell me the reasons for resistance to change in your organization?
22. Can you please tell me about the various sources of information regarding the innovative technologies in your organization?
23. Can you please tell me about the aftersales support expected from the innovator?
24. Do you think variables like History and Frequency of past purchases; familiarity etc. affect the purchasing patterns in your organization?
25. Do you think Ease of learning and Usage and Complexity of the technology affect the total efforts to be put in by the end-user?
26. Do you think variables like beliefs and outcome, production timeliness, User experiences, etc. contribute to User satisfaction and Trust towards innovation in an organization?

27. Do you think variables like CEO and Individual innovativeness, Market competition, Curiosity, and R&D affect learning capacity of your organization?
28. Do you think inter-organizational dependence, Market structure, Market Competition, and Organizational Openness affect the learning capacity of your organization?
29. Do you think variables like Price, Budget allocation, Switching cost, etc. influence the affordability of innovative technologies in an organization?
30. Do you think variables like Cost savings, Profitability, Safety, Enhanced Job Performance, Environmental benefits, Long term consequences, etc. affect the usefulness of the technologies in the organization?
31. Do you think Security, Safety, Time budgets, perceived innovation characteristics, and the Market potential affect the usefulness of the technologies?
32. Do you think variables like Infrastructure, Managerial skills, Government support, Innovator support, Licensing, Leadership, Organizational Strategies, etc. influences facilitating conditions of an organization?
33. Do you think Proper Technology assessment, General Economic Conditions, Relationships, Degree of Innovativeness, and Organizational Priorities affect the facilitating conditions of the organization?
34. Can you please tell me about the various resources required for adoption and utilization?
35. Do you think variables like performance, quality of results, demonstration of the technology, product features enhance the scientific credibility of the technologies?
36. Can you please tell me about the variables affecting the compliance requirements in your organization?
37. Do you think image enhancement, reference group, social pressure, Network externality, geographical proximity, Central decision-maker,

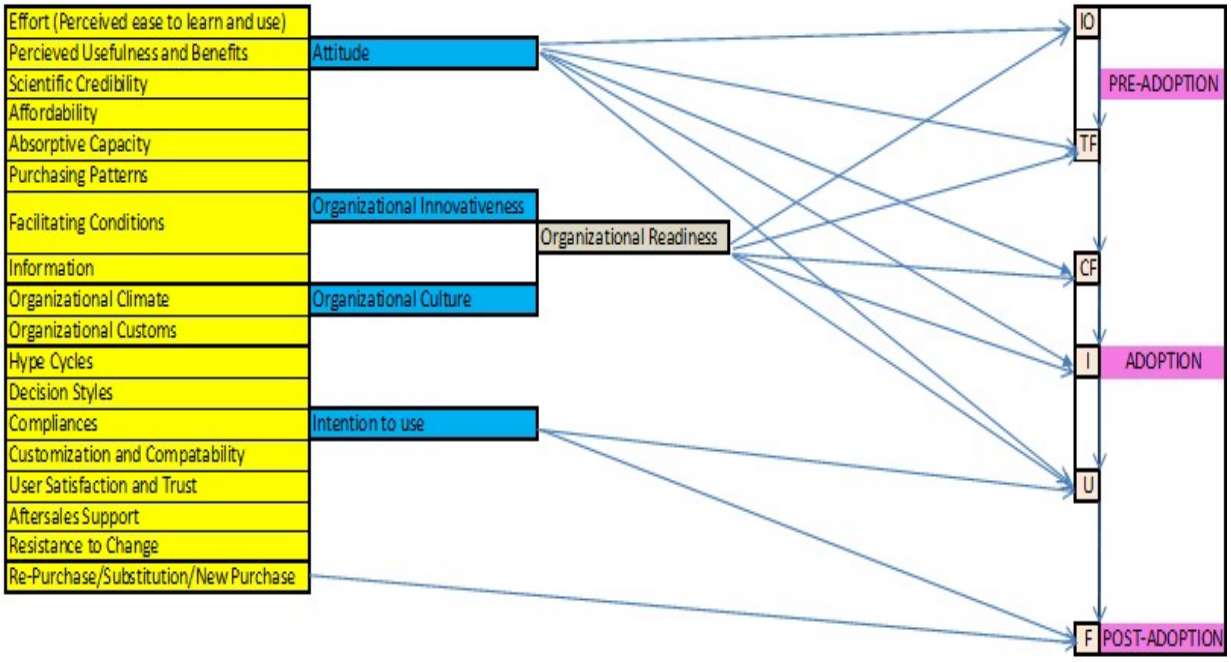
Network membership, Legitimization, Reputation of the vendor affect compliance requirements?

38. Can you please tell me about the variables affecting the customization and compatibility requirements?
39. Do you think variables like Organizational routines, Norms, etc. affect the customs in your organization?
40. Do you think variables like Job Characteristics, Cross-functional teams, Authority, etc. affect the Organizational climate of your organization?
41. Do you think variables like Organizational Structure, End-user involvement, etc. influence the decisions in an organization?
42. Do you think age, motivation, communication channels, and voluntariness affect the decisions in organizations?

8.2.2 RESULTS OF DATA ANALYSIS

- The analysis started with the 147 Variables in the conceptual lens, and only 83 were found relevant to adoption of innovative drilling technologies. The Researcher answers the RO1.

8.2.3 RESULTING FRAMEWORK WITH 83 VARIABLES (CONCEPTUAL LENS 2)


Effort (Perceived ease to learn and use)
Percieved Usefulness and Benefits
Scientific Credibility
Affordability
Absorptive Capacity
Purchasing Patterns
Facilitating Conditions
Information
Organizational Climate
Organizational Customs
Hype Cycles
Decision Styles
Compliances
Customization and Compatability
User Satisfaction and Trust
Aftersales Support
Resistance to Change
Re-Purchase/Substitution/New Purchase
Attitude
Organizational Innovativeness
Organizational Culture
Organizational Readiness
Intention to use
IO
TF
CF
I
U
F
PRE-ADOPTION
ADOPTION
POST-ADOPTION

S No	Variables/Factors	
1	Industry Trends	
2	Optimism	Hype Cycles
3	Risk/Uncertainty	
4	Satisfaction with Old Practices	Resistance to Change
5	Fear of Change/Self Efficacy	
6	Advertisement	
7	Social Media	
8	Success Stories/Product Reviews	Information
9	Referrals	
10	Technical Journals	
11	Seminar/Workshops	
12	Aftersales Service	
13	Tech Support	Aftersales Support
14	History & Frequency of Past purchases	
15	Familiarity	Purchasing Patterns
16	Ease of Use	
17	Ease to learn	Efforts
18	Complexity	
19	Beliefs and Evaluation of outcome	
20	Prior User Experience	User Satisfaction and Trust
21	Pleasurable Experience	
22	Production Timeliness	
23	CEO and Individual Innovativeness	
24	Market Structure & Competition	Absorptive capacity
25	R&D	
26	Organizational Openness	
27	Switching Cost	
28	Budget allocation	Affordability
29	Price	
30	Cost Savings & Profitability - Short and Long Term	
31	Environmental Benefits	

32	Security	Perceived Usefulness and Benefits
33	Safety	
34	Time Budget	
35	Enhanced Job Performance	
36	Complimentary Infrastructure	
37	Government Support & General Economic Conditions	
38	Innovator Support	Facilitating Conditions
39	Leadership, Management support and Managerial Skills	
40	Motivated, Competent and Qualified Work force	
41	Organizational Priorities & Strategies	
42	Higher Resale Price	
43	Technological advances	
44	Alternatives	Re-Purchase/Substitution/New Purchase
45	Brand Loyalty	
46	Re-Invention	
47	Field Trials Results	
48	Product Features	Scientific Credibility
49	Reputation of the Vendor	
50	Group Pressure and Image Enhancement Compliances	Compliances
51	Statutory and Industry Standards Compliance	
52	Fit to Work Settings	
53	Local Adaptations	Customization and Compatibility
54	Job Roles and Tenure	
55	Authority	Organizational Climate
56	Working Environment - Relationships and Rewards	
57	Organizational Norms	Organizational Customs
58	Organizational Routines	
59	Organization Size and Structure	
60	Communication Channels	Decision Styles
61	End User Involvement	

Figure 8.2 Output Framework (Conceptual Lens for Framework Analysis)

8.3 CHAPTER CONCLUSION

The Researcher eliminates the irrelevant variables, and only the relevant variables go as input to the subsequent stages of data analysis. The framework with relevant variables becomes the conceptual lens/preliminary framework for the Framework Analysis. Deleting the irrelevant variables saves time and effort of the researcher during subsequent stages of data analysis – During Framework Analysis.

CHAPTER 9

PROPOSING FRAMEWORK (USING FRAMEWORK ANALYSIS) TO ENHANCE THE ADOPTION

9.1 INTRODUCTION

Framework Analysis is used to answer Research Objective -2. Framework Analysis has got four stages of data analysis - Two stages of familiarization followed by two stages of interviews. The output of the fourth stage answers RO2.

9. 2 STAGE 1 (FAMILIARIZATION STAGE USING DOCUMENT ANALYSIS)

The output Frame Work of RO1 – becomes the Conceptual lens - CONCEPTUAL LENS -2 for the first stage of framework analysis – Familiarization using Document Analysis. The Researcher revises the Interview protocol in line with CONCEPTUAL LENS - 2 to REVISED INTERVIEW PROTOCOL – 2. The Researcher furnishes the detailed data analysis of Stage 1 of Framework Analysis in the published paper "FRAMEWORK ANALYSIS (STAGE 1): CREATING A FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS" – placed in Appendix H

9.2.1 REVISED INTERVIEW PROTOCOL – 2 IN LINE WITH CONCEPTUAL LENS – 2

1. Can you please explain whether the general attitude and readiness of an organization motivates you to search for an innovation opportunity in your organization?

2. Can you please explain whether innovativeness of an organization and organizational culture affect the readiness of an organization?
3. Can you please explain whether the general attitude and readiness of an organization affect the technology finalization in your organization?
4. Can you please explain whether the readiness of an organization and attitude affect contract finalization?
5. Can you please explain whether the readiness of an organization and attitude affect the implementation of innovative technologies in an organization?
6. Can you please explain whether the general attitude, organizational readiness, and intention to use affect the utilization of innovation in your organization?
7. Can you please explain whether the intention to use and the decision to repurchase/substitution/new purchase affect the future usage of innovative technologies in your organization?
8. Can you please explain whether the variables like Ease of identification and usage, Affordability, Usefulness, and Scientific credibility lead to a favorable attitude for problem-solving?
9. Can you please explain whether the variables like absorptive capacity, patterns of purchase, facilitating conditions, and information affect organizational innovativeness?
10. Can you please explain whether organizational climate and customs affect organizational culture?
11. Can you please explain whether hype cycles, decision types, various compliances, customization and compatibility, satisfaction, aftersales support, and resistance to change affect intention to use innovative technology in your organization?
12. Can you please explain whether alternatives, technological advances, Re-Invention, Higher resale price, and brand loyalty affect the substitution/re-purchase/new purchase decisions?

13. Can you please explain whether Industry Trends and Optimism affect hype cycles?
14. Can you please explain the reasons for resistance to change in your organization?
15. Can you please explain the various sources of information regarding the innovative technologies in your organization?
16. Can you please explain about the aftersales support expected from the innovator?
17. Can you please explain whether variables like History and Frequency of past purchases and familiarity affect the purchasing patterns in your organization?
18. Can you please explain whether Ease of learning and Usage and Complexity of the technology affect the total efforts to be put in by the end-user?
19. Can you please explain whether variables like beliefs and outcome, production timeliness and User experiences contribute to User satisfaction and Trust towards innovation in an organization?
20. Can you please explain whether variables like CEO and Individual innovativeness, R&D, Market structure, Market Competition, and Organizational Openness affect the learning capacity of your organization?
21. Can you please explain whether variables like Price, Budget allocation, and Switching cost influence affordability of innovative technologies in an organization?
22. Can you please explain whether variables like Cost savings, Profitability, Safety, Enhanced Job Performance, Environmental benefits, Security, and Time budgets affect the usefulness of the technologies?
23. Can you please explain whether variables like Infrastructure, Managerial skills, Support and Leadership, Government support and General Economic Conditions, Innovator support, Organizational Priorities and

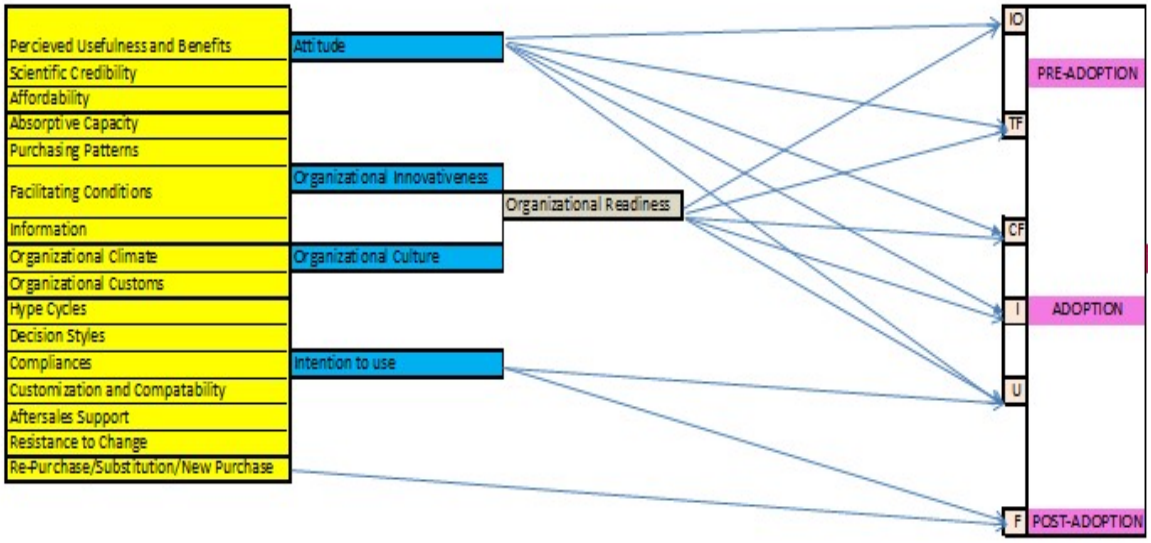
Strategies, and Motivated and Competent Workforce influence facilitating conditions of an organization?

24. Can you please explain whether variables like quality of results, product features, and reputation of the vendor enhance the scientific credibility of the technologies?
25. Can you please explain whether variables like Group pressure and Image Enhancement and Statutory and Industry Standards affect the compliance requirements in your organization?
26. Can you explain whether variables Fit to work settings and Local adaptations affect the customization and compatibility requirements?
27. Can you please explain whether variables like Organizational routines and Norms affect the customs in your organization?
28. Can you please explain whether variables like Job Roles and Tenure, Authority and Rewards and Relationships in the working environments affect the Organizational climate of your organization?
29. Can you please explain whether variables like Organizational Size and Structure, End-user involvement, and communication channels affect the decisions in organizations?

9.2.2 RESULTS OF DATA ANALYSIS

- Two new variables emerged - “Central Innovation Office” and “Age.”
- Some Variables got eliminated – “Efforts” + Associated Variables, “User Satisfaction and Trust” + Associated Variables, “Familiarity,” “Innovator Support,” “Environmental Benefits,” “Environmental Benefits,” “Trade up or Buyback” and “Brand Loyalty.”

9.2.3 RESULTING FRAMEWORK (CONCEPTUAL LENS – 3)


Percieved Usefulness and Benefits
Scientific Credibility
Affordability
Absorptive Capacity
Purchasing Patterns
Facilitating Conditions
Information
Organizational Climate
Organizational Customs
Hype Cycles
Decision Styles
Compliances
Customization and Compatability
Aftersales Support
Resistance to Change
Re-Purchase/Substitution/New Purchase
Attitude
Organizational Innovativeness
Organizational Culture
Intention to use
Organizational Readiness
IO
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CF
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U
F
PRE-ADOPTION
ADOPTION
POST-ADOPTION

S No	Variables/Factors	
1	Industry Trends	
2	Optimism	Hype Cycles
3	Risk/Uncertainty	
4	Satisfaction with Old Practices	Resistance to Change
5	Fear of Change/Self Efficacy	
6	Sources of Information	Information
7	Aftersales Service	
8	Tech Support	Aftersales Support
9	CEO and Individual Innovativeness	
10	Market Structure & Competition	Absorptive capacity
11	R&D	
12	Organizational Openness	
13	History & Frequency of Past purchases	Purchasing Patterns
14	Cost Savings & Profitability - Short and Long Term	
15	Security	Perceived Usefulness and Benefits
16	Safety	
17	Time Budget	
18	Enhanced Job Performance	
19	Complimentary Infrastructure	
20	Central Innovation Office (Newly Added)	
21	Government Support & General Economic Conditions	Facilitating Conditions
22	Leadership, Management support and Managerial Skills	
23	Motivated, Competent and Qualified Work force	
24	Organizational Priorities & Strategies	
25	Price	
26	Switching cost	Affordability
27	Budget	
28	Technological advances & Alternatives	Re-Purchase/Substitution/New Purchase
29	Re-Invention	
30	Field Trials Results	
31	Product Features	Scientific Credibility
32	Reputation of the Vendor	
33	Group Pressure and Image Enhancement Compliances	Compliances
34	Statutory and Industry Standards Compliance	
35	Fit to Work Settings	
36	Local Adaptations	Customization and Compatibility
37	Job Roles and Tenure	
38	Authority	Organizational Climate
39	Working Environment - Relationships and Rewards	
40	Organizational Norms	Organizational Customs
41	Organizational Routines	
42	Organization Size and Structure	
43	Communication Channels	Decision Styles
44	Age (Newly Added)	
45	End User Involvement	

Figure 9. 1 Output Frame Work after Stage 1

9.3 STAGE 2 (FAMILIARIZATION STAGE USING DOCUMENT ANALYSIS)

The output Frame Work of Stage 1 of Familiarization – becomes the Conceptual lens - CONCEPTUAL LENS -3 for the second stage of framework analysis – Familiarization using Document Analysis. The Researcher revises the Interview protocol in line with CONCEPTUAL LENS - 3 to REVISED INTERVIEW PROTOCOL – 3. The Researcher furnishes the detailed data analysis of Stage 2 of Framework Analysis in the published paper "FRAMEWORK ANALYSIS (STAGE 2): CREATING A FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS" – placed in Appendix I

9.3.1 REVISED INTERVIEW PROTOCOL – 3 IN LINE WITH CONCEPTUAL LENS – 3

1. Can you please explain whether the general attitude and readiness of an organization motivate you to search for an innovation opportunity in your organization?
2. Can you please explain whether innovativeness of an organization and organizational culture affect the readiness of an organization?
3. Can you please explain whether the general attitude and readiness of an organization affect the technology finalization in your organization?
4. Can you please explain whether the readiness of an organization and attitude affect contract finalization?
5. Can you please explain whether the readiness of an organization and attitude affect the implementation of innovative technologies in an organization?
6. Can you please explain whether the general attitude, organizational readiness, and intention to use affect the utilization of innovation in your organization?

7. Can you please explain whether the intention to use and the decision to repurchase/substitution/new purchase affect the future usage of innovative technologies in your organization?
8. Can you please explain whether the variables like Affordability, Usefulness and Scientific credibility lead to a favorable attitude for problem-solving?
9. Can you please explain whether the variables like absorptive capacity, patterns of purchase, facilitating conditions, and information affect organizational innovativeness?
10. Can you please explain whether organizational climate and customs affect organizational culture?
11. Can you please explain whether hype cycles, decision types, various compliances, customization and compatibility, aftersales support, and resistance to change affect intention to use innovative technology in your organization?
12. Can you please explain whether alternatives, technological advances, and Re-Invention affect the substitution/re-purchase/new purchase decisions?
13. Can you please explain whether Industry Trends and Optimism affect hype cycles?
14. Can you please explain the reasons for resistance to change in your organization?
15. Can you please explain the various sources of information regarding the innovative technologies in your organization?
16. Can you please explain about the aftersales support expected from the innovator?
17. Can you please explain whether variables like History and Frequency of past purchases and familiarity affect the purchasing patterns in your organization?
18. Can you please explain whether variables like CEO and Individual innovativeness, R&D, Market structure, Market Competition, and

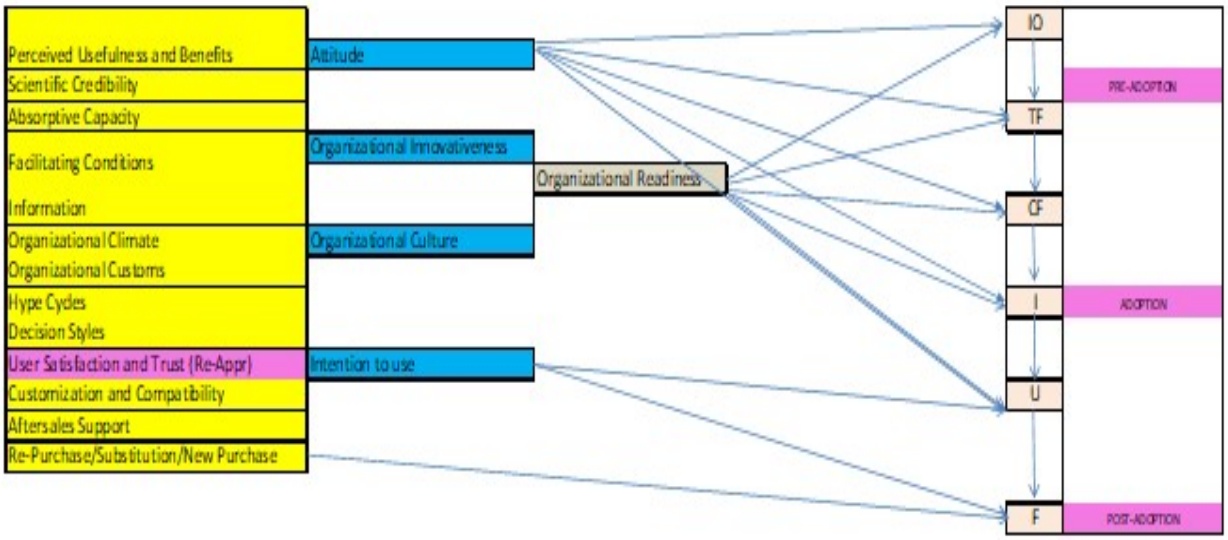
Organizational Openness affect the learning capacity of your organization?

19. Can you please explain whether variables like Price, Budget allocation, and Switching cost influence affordability of innovative technologies in an organization?
20. Can you please explain whether variables like Cost savings, Profitability, Safety, Enhanced Job Performance, Security, and Time budgets affect the usefulness of the technologies?
21. Can you please explain whether variables like Infrastructure, Managerial skills, Support and Leadership, Government support and General Economic Conditions, Organizational Priorities and Strategies, Central Innovation Office and Motivated and Competent Workforce influence facilitating conditions of an organization?
22. Can you please explain whether variables like quality of results, product features, and reputation of the vendor enhance the scientific credibility of the technologies?
23. Can you please explain whether variables like Group pressure and Image Enhancement and Statutory and Industry Standards affect the compliance requirements in your organization?
24. Can you explain whether variables Fit to work settings and Local adaptations affect the customization and compatibility requirements?
25. Can you please explain whether variables like Organizational routines and Norms affect the customs in your organization?
26. Can you please explain whether variables like Job Roles and Tenure, Authority and Rewards and Relationships in the working environments affect the Organizational climate of your organization?
27. Can you please explain whether variables like Organizational Size and Structure, End-user involvement, Age, and communication channels affect the decisions in organizations?

9.3.2 RESULTS OF DATA ANALYSIS

- The Variables “Environmental Benefit” and “User Satisfaction and Trust” re-appeared in the data analysis.
- Variables - “Affordability” and associated variables, “Total Efforts” and associated variables, “Purchasing Patterns” and associated variables, “Compliance” and associated variables, “Resistance to Change” and associated variables, “Brand Loyalty”, “Central Innovation Office”, “Trade-Up or Buyback” and “Innovator Support” got eliminated in due course of data analysis.

9.3.3 RESULTING FRAMEWORK (CONCEPTUAL LENS – 4)



S No	Variables/Factors	
1	Industry Trends	
2	Optimism	Hype Cycles
3	Beliefs and Evaluation of Outcome	
4	User Experience	User Satisfaction and Trust (Re-Appr)
5	Production Timeliness	
6	Sources of Information	Information
7	Aftersales Service	
8	Tech Support	Aftersales Support
9	CEO and Individual Innovativeness	
10	Market Structure & Competition	Absorptive capacity
11	R&D	
12	Organizational Openness	
13	Cost Savings & Profitability - Short and Long Term	
14	Security	
15	Safety	
16	Time Budget	Perceived Usefulness and Benefits
17	Environmental Benefits (Re-Appr)	
18	Enhanced Job Performance	
19	Complimentary Infrastructure	
20	Government Support & General Economic Conditions	
21	Leadership, Management support and Managerial Skills	Facilitating Conditions
22	Motivated, Competent and Qualified Work force	
23	Organizational Priorities & Strategies	
24	Technological advances & Alternatives	Re-Purchase/Substitution/New Purchase
25	Re-Invention	
26	Field Trials Results	
27	Product Features	Scientific Credibility
28	Reputation of the Vendor	
29	Fit to Work Settings	
30	Local Adaptations	Customization and Compatibility
31	Job Roles and Tenure	
32	Authority	Organizational Climate
33	Working Environment - Relationships and Rewards	
34	Organizational Norms	Organizational Customs
35	Organizational Routines	
36	Organization Size and Structure	
37	Communication Channels	Decision Styles
38	Age	
39	End User Involvement	

Figure 9. 2 Output Framework after Stage 2

9.4 STAGE 3 (INTERVIEW STAGE / GROUNDED THEORY)

The output Frame Work of Stage 2 of Familiarization – becomes the Conceptual lens - CONCEPTUAL LENS -4 for the third stage of framework analysis – Data collection through Interviews and Qualitative analysis using Grounded Theory. The Researcher revises the Interview protocol in line with CONCEPTUAL LENS - 4 to REVISED INTERVIEW PROTOCOL – 4. The Researcher furnishes the detailed data analysis of Stage 3 of Framework Analysis in the published paper "FRAMEWORK ANALYSIS (STAGE 3): CREATING A FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS" – placed in Appendix J

9.4.1 REVISED INTERVIEW PROTOCOL – 4 IN LINE WITH CONCEPTUAL LENS – 4

1. Can you please explain whether the general attitude and readiness of an organization motivate you to search for an innovation opportunity in your organization?
2. Can you please explain whether innovativeness of an organization and organizational culture affect the readiness of an organization?
3. Can you please explain whether the general attitude and readiness of an organization affect the technology finalization in your organization?
4. Can you please explain whether the readiness of an organization and attitude affect contract finalization?
5. Can you please explain whether the readiness of an organization and attitude affect the implementation of innovative technologies in an organization?
6. Can you please explain whether the general attitude, organizational readiness, and intention to use affect the utilization of innovation in your organization?

7. Can you please explain whether the intention to use and the decision to repurchase/substitution/new purchase affect the future usage of innovative technologies in your organization?
8. Can you please explain whether the variables like Usefulness and Scientific credibility lead to a favorable attitude for problem-solving?
9. Can you please explain whether the variables like absorptive capacity, facilitating conditions, and information affect organizational innovativeness?
10. Can you please explain whether organizational climate and customs affect organizational culture?
11. Can you please explain whether hype cycles, decision type, customization and compatibility, user satisfaction and trust, and aftersales support affect intention to use innovative technology in your organization?
12. Can you please explain whether alternatives, technological advances, and Re-Invention affect the substitution/re-purchase/new purchase decisions?
13. Can you please explain whether Industry Trends and Optimism affect hype cycles?
14. Can you please explain the various sources of information regarding the innovative technologies in your organization?
15. Can you please explain about the aftersales supports expected from the innovator?
16. Can you please explain whether variables like CEO and Individual innovativeness, R&D, Market structure, Market Competition, and Organizational Openness affect the learning capacity of your organization?
17. Can you please explain whether variables like Cost savings, Profitability, Safety, Enhanced Job Performance, Security, Environmental Benefits, and Time budgets affect the usefulness of the technologies?
18. Can you please explain whether variables like Infrastructure, Managerial skills, Support and Leadership, Government support and General

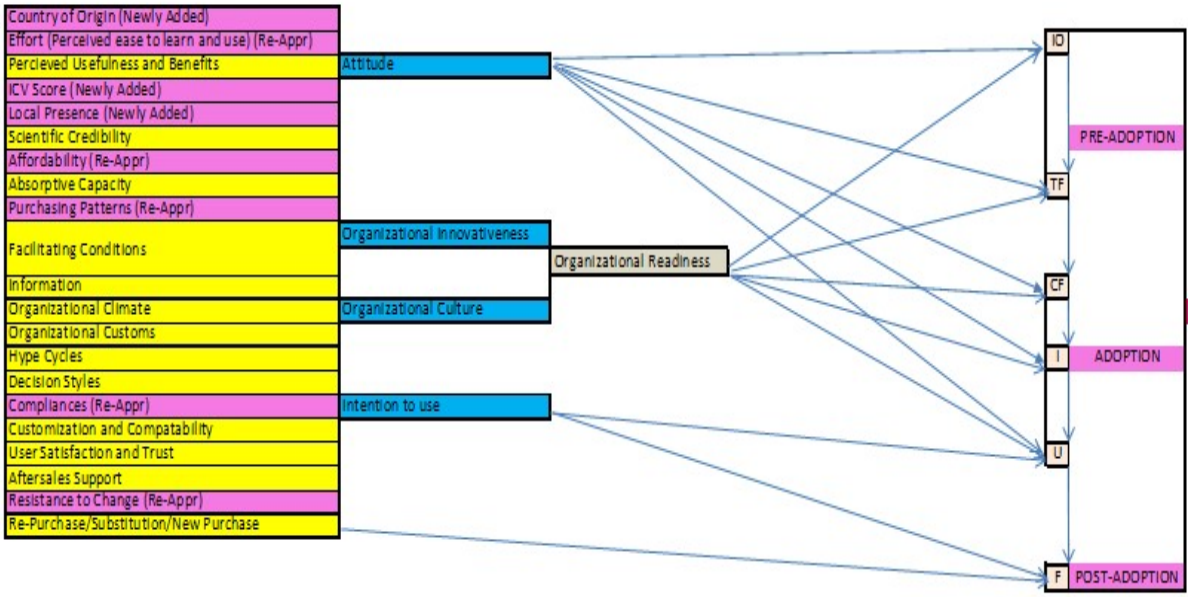
Economic Conditions, Organizational Priorities and Strategies and Motivated and Competent Workforce influence facilitating conditions of an organization?

19. Can you please explain whether variables like quality of results, product features, and reputation of the vendor enhance the scientific credibility of the technologies?
20. Can you explain whether variables Fit to work settings and Local adaptations affect the customization and compatibility requirements?
21. Can you please explain whether variables like Organizational routines and Norms affect the customs in your organization?
22. Can you please explain whether variables like Job Roles and Tenure, Authority and Rewards and Relationships in the working environments affect the Organizational climate of your organization?
23. Can you please explain whether variables like Organizational Size and Structure, End-user involvement, Age, and communication channels affect the decisions in organizations?
24. Can you please explain about the variables like User experiences, Production Timeliness, and Beliefs affect the User satisfaction and Trust?

9.4.2 RESULTS OF DATA ANALYSIS

- "Resistance to Change" and associated variables, "Compliances" and associated variables, "Purchasing Patterns" and associated variables, "Affordability" and associated variables, "Efforts" and associated variables, "Trade up or Buyback", "Brand Loyalty", "Innovator Support" and "Central Innovation Office" re-appeared in the data analysis
- "Country of Origin," "ICV Score" and "Local Presence" are the newly emerged variables

9.4.3 RESULTING FRAMEWORK (CONCEPTUAL LENS – 5)


Country of Origin (Newly Added)
Effort (Perceived ease to learn and use) (Re-Appr)
Percieved Usefulness and Benefits
ICV Score (Newly Added)
Local Presence (Newly Added)
Scientific Credibility
Affordability (Re-Appr)
Absorptive Capacity
Purchasing Patterns (Re-Appr)
Facilitating Conditions
Information
Organizational Climate
Organizational Customs
Hype Cycles
Decision Styles
Compliances (Re-Appr)
Customization and Compatability
User Satisfaction and Trust
Aftersales Support
Resistance to Change (Re-Appr)
Re-Purchase/Substitution/New Purchase
Attitude
Organizational Innovativeness
Organizational Readiness
Organizational Culture
Intention to use
IO
TF
CF
I
U
F
PRE-ADOPTION
ADOPTION
POST-ADOPTION

S No	Variables/Factors	
1	Industry Trends	
2	Optimism	Hype Cycles
3	Risk/Uncertainty	
4	Satisfaction with Old Practices	Resistance to Change (Re-Apr.)
5	Fear of Change/Self Efficacy	
6	Sources of Information	Information
7	Aftersales Service	
8	Tech Support	Aftersales Support
9	History & Frequency of Past purchases	
10	Familiarity	Purchasing Patterns (Re-Appr)
11	Ease of Use	
12	Ease to learn	Efforts (Re-Appr)
13	Complexity	
14	Beliefs and Evaluation of outcome	
15	User Experience	User Satisfaction and Trust
16	Production Timeliness	
17	CEO and Individual Innovativeness	
18	Market Structure & Competition	Absorptive capacity
19	R&D	
20	Organizational Openness	
21	Switching Cost	
22	Budget allocation	Affordability (Re-Appr)
23	Price	
24	Cost Savings & Profitability - Short and Long Term	
25	Environmental Benefits	
26	Security	Perceived Usefulness and Benefits
27	Safety	
28	Time Budget	
29	Enhanced Job Performance	
30	Complimentary Infrastructure	

31	Central Innovation Office (Re-Appr)	
32	Government Support & General Market Conditions	
33	Innovator Support (Re-Appr)	Facilitating Conditions
34	Leadership, Management support and Managerial Skills	
35	Motivated, Competent and Qualified Work force	
36	Organizational Priorities & Strategies	
37	Trade up or Buy Back (Re-Appr)	
38	Technological advances & Alternatives	Re-Purchase/Substitution/New Purchase
39	Brand Loyalty (Re-Appr)	
40	Re-Invention	
41	Field Trials Results	
42	Product Features	Scientific Credibility
43	Reputation of the Vendor	
44	Group Pressure and Image Enhancement Compliances	Compliances (Re-Appr)
45	Statutory and Industry Standards Compliance	
46	Fit to Work Settings	
47	Local Adaptations	Customization and Compatibility
48	Job Roles and Tenure	
49	Authority	Organizational Climate
50	Working Environment - Relationships and Rewards	
51	Organizational Norms	Organizational Customs
52	Organizational Routines	
53	Organization Size and Structure	
54	Communication Channels	Decision Styles
55	Age	
56	End User Involvement	

Figure 9. 3 Output Framework after Stage 3

9.5 STAGE 4 (INTERVIEW STAGE / GROUNDED THEORY)

The output Frame Work of Stage 3 of Interview – becomes the Conceptual lens - CONCEPTUAL LENS -5 for the fourth stage of framework analysis – Data collection through Interviews and Qualitative analysis using Grounded Theory. The Researcher revises the Interview protocol in line with CONCEPTUAL LENS - 5 to REVISED INTERVIEW PROTOCOL – 5. The Researcher furnishes the detailed data analysis of Stage 4 of Framework Analysis in the published paper "FRAMEWORK ANALYSIS (STAGE 4): PROPOSING A VALIDATED FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS" – placed in Appendix K

9.5.1 REVISED INTERVIEW PROTOCOL – 5 IN LINE WITH CONCEPTUAL LENS – 5

1. Can you please explain whether the general attitude and readiness of an organization motivate you to search for an innovation opportunity in your organization?
2. Can you please explain whether innovativeness of an organization and organizational culture affect the readiness of an organization?
3. Can you please explain whether the general attitude and readiness of an organization affect the technology finalization in your organization?
4. Can you please explain whether the readiness of an organization and attitude affect contract finalization?
5. Can you please explain whether the readiness of an organization and attitude affect the implementation of innovative technologies in an organization?
6. Can you please explain whether the general attitude, organizational readiness, and intention to use affect the utilization of innovation in your organization?
7. Can you please explain whether the intention to use and the decision to repurchase/substitution/new purchase affect the future usage of innovative technologies in your organization?
8. Can you please explain whether the variables like Usefulness, Scientific credibility, Efforts, Affordability, ICV Score, Local Presence, and Country of Origin lead to a favorable attitude for problem-solving?
9. Can you please explain whether the variables like absorptive capacity, facilitating conditions and information and purchasing patterns affect organizational innovativeness?
10. Can you please explain whether organizational climate and customs affect organizational culture?
11. Can you please explain whether hype cycles, decision type, compliances, customization and compatibility, user satisfaction and trust, resistance to

change, and aftersales support affect intention to use innovative technology in your organization?

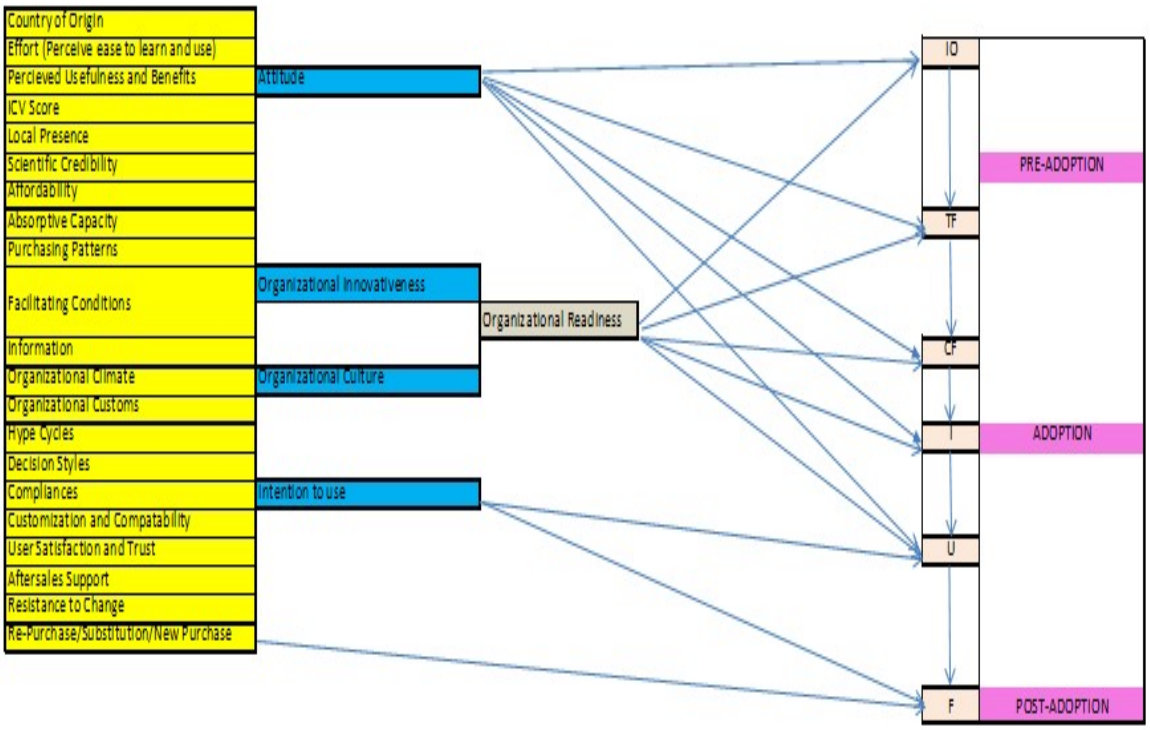
12. Can you please explain whether alternatives, technological advances, Trade up or buyback, Brand Loyalty, and Re-Invention affect the substitution/re-purchase/new purchase decisions?
13. Can you please explain whether Industry Trends and Optimism affect hype cycles?
14. Can you please explain the various sources of information regarding the innovative technologies in your organization?
15. Can you please explain whether Risk, Satisfaction with Old practices, and Fear of Change affect the Resistance to change in your organization?
16. Can you please explain about the aftersales support expected from the innovator?
17. Can you please explain whether History and Frequency of Past purchases and Familiarity affect the Purchasing patterns in your organization?
18. Can you please explain whether Ease of use and learn and complexity affect the total efforts put in by the end-user?
19. Can you please explain whether variables like CEO and Individual innovativeness, R&D, Market structure, Market Competition, and Organizational Openness affect the learning capacity of your organization?
20. Can you please explain whether beliefs and evaluation, User experience, and production timeliness affect user satisfaction and trust in innovative technologies?
21. Can you please explain whether Switching cost, Budget allocation, and Price influence the affordability of innovative technologies?
22. Can you please explain whether variables like Cost savings, Profitability, Safety, Enhanced Job Performance, Security, Environmental Benefits, and Time budgets affect the usefulness of the technologies?

23. Can you please explain whether variables like Infrastructure, Managerial skills, Support and Leadership, Government support and General Economic Conditions, Organizational Priorities and Strategies, Central Innovation Office, Innovator Support and Motivated and Competent Workforce influence facilitating conditions of an organization?
24. Can you please explain whether variables like quality of results, product features and reputation of the vendor enhance the scientific credibility of the technologies?
25. Can you please explain whether Group pressure and Image Enhancement and Statutory and industry standards affect the compliance requirements?
26. Can you explain whether variables Fit to work settings and Local adaptations affect the customization and compatibility requirements?
27. Can you please explain whether variables like Organizational routines and Norms affect the customs in your organization?
28. Can you please explain whether variables like Job Roles and Tenure, Authority and Rewards and Relationships in the working environments affect the Organizational climate of your organization?
29. Can you please explain whether variables like Organizational Size and Structure, End-user involvement, Age, and communication channels affect the decisions in organizations?

9.5.2 RESULTS OF DATA ANALYSIS

- The Frame Work proposed by the Researcher in the Third Stage of Framework Analysis gets validated in the Fourth and Final stage.
- No New Variables/Relationships emerged or existing got eliminated.
- Framework – Proposed to enhance Innovation adoption.

9.5.3 RESULTING FRAMEWORK (FINAL STAGE – PROPOSED FRAMEWORK)


Country of Origin
Effort (Perceive ease to learn and use)
Perceived Usefulness and Benefits
ICV Score
Local Presence
Scientific Credibility
Affordability
Absorptive Capacity
Purchasing Patterns
Facilitating Conditions
Information
Organizational Climate
Organizational Customs
Hype Cycles
Decision Styles
Compliances
Customization and Compatability
User Satisfaction and Trust
Aftersales Support
Resistance to Change
Re-Purchase/Substitution/New Purchase
Attitude
Organizational Innovativeness
Organizational Culture
Intention to use
Organizational Readiness
IO
TF
CF
I
U
F
PRE-ADOPTION
ADOPTION
POST-ADOPTION

S No	Variables/Factors	
1	Industry Trends	
2	Optimism	Hype Cycles
3	Risk/Uncertainty	
4	Satisfaction with Old Practices	Resistance to Change
5	Fear of Change/Self Efficacy	
6	Sources of Information	Information
7	Aftersales Service	
8	Tech Support	Aftersales Support
9	History & Frequency of Past purchases	
10	Familiarity	Purchasing Patterns
11	Ease of Use	
12	Ease to learn	Efforts
13	Complexity	
14	Beliefs and Evaluation of outcome	
15	User Experience	User Satisfaction and Trust
16	Production Timeliness	
17	CEO and Individual Innovativeness	
18	Market Structure & Competition	Absorptive capacity
19	R&D	
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23	Price	
24	Cost Savings & Profitability - Short and Long Term	
25	Environmental Benefits	
26	Security	Perceived Usefulness and Benefits
27	Safety	
28	Time Budget	
29	Enhanced Job Performance	
30	Complimentary Infrastructure	

31	Central Innovation Office	
32	Government Support & General Market Conditions	
33	Innovator Support	Facilitating Conditions
34	Leadership, Management support and Managerial Skills	
35	Motivated, Competent and Qualified Work force	
36	Organizational Priorities & Strategies	
37	Trade up or Buy Back	
38	Technological advances & Alternatives	Re-Purchase/Substitution/New Purchase
39	Brand Loyalty	
40	Re-Invention	
41	Field Trials Results	
42	Product Features	Scientific Credibility
43	Reputation of the Vendor	
44	Group Pressure and Image Enhancement Compliances	Compliances
45	Statutory and Industry Standards Compliance	
46	Fit to Work Settings	
47	Local Adaptations	Customization and Compatibility
48	Job Roles and Tenure	
49	Authority	Organizational Climate
50	Working Environment - Relationships and Rewards	
51	Organizational Norms	Organizational Customs
52	Organizational Routines	
53	Organization Size and Structure	
54	Communication Channels	Decision Styles
55	Age	
56	End User Involvement	

Figure 9. 4 Output Framework after Stage 4

9.6 CHAPTER CONCLUSION

The output of the Framework Analysis – the Validated Framework after the fourth and final stage of framework analysis becomes the "Holistic Reference Framework" to enhance adoption. The role of variables affecting various stages of adoption can be explained using Framework Analysis. The Framework also bridges the Theoretical Gap by proposing the Pre – Adoption variables. The Frame Work also helps organizations to formulate variables/innovation specific strategies to enhance adoption.

CHAPTER 10

EXPLAINING THE VARIABLES AFFECTING THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS

10.1 INTRODUCTION

Adoption of Innovative Drilling Technologies is slow in Oil and Gas compared to other sectors. A detailed study of variables influencing the adoption of innovative drilling technologies is required to formulate variable and organization/department-specific strategies to enhance adoption. The top executives of Oil and Gas companies do not have the time to go through the whole report or volumes of data analysis. They need the variables specific explanations in a Nutshell.

In the data analysis stage, the researcher has used pre-defined codes from the existing theories related to innovation adoption. But to formulate innovation adoption strategies, the variables have to be analyzed from an oil and gas perspective – Researcher did this analysis from Oil and Gas perspective during data analysis. The new insights/observations regarding variables emerged during various stages of data analysis have to be categorized and consolidated under the relevant variables for better understanding.

10.2 CATEGORIZATION AND CONSOLIDATION METHOD

The researcher lists down in a word document or excels sheet the relevant variables from the Preliminary Framework proposed by the researcher in the paper titled “Constructing a Conceptual Lens/Preliminary Framework for Further Testing in Upstream Oil and Gas.” The below template can be used to categorize and consolidate the new insights or observations as or when it emerges during data analysis.

Table 10. 1 Collection of Insights for Consolidation

Var. Name	Definition	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
1						
2						

The Researcher has gone for data analysis consisting of Five Stages. The researcher has used Pre-Defined codes from the existing literature. So the "Pre-Definition" will be a starting point for further explanation of variables. These Variables or Codes gets refined at each stage of data analysis. The Researcher categorizes and populates the new insights or observations that emerged during the data analysis in the above table – stage wise. The new insights or observation are added to the existing definition to give a "Sector-Specific" explanation of variables. The Researcher also enters the new variables or codes emerging during data analysis in the table. Once the researcher finishes his data analysis part – he will have a table with variable specific observations/insights. The researcher needs to go through the Memos and Transcript again and again till the saturation occurs – till the point he feels he cannot generate any new insight or information or observation. This table should not be mistaken for Memos. The Researcher enters only new information/insights/observations from the Memos and Transcripts into this table. The purpose of this table is to categorize and consolidate new variable specific information. The Researcher takes only the relevant variables emerging in the last and final phase of data analysis to the final report. Other variables are deemed to be irrelevant and discarded.

10.3 EXPLANATION OF VARIABLES

10.3.1 ATTITUDE

Attitude is how we feel or think about something at a certain point in time. Attitudes can be positive or negative views about a person, place, thing, or event. Attitude is a state of mind which directs the behavior towards an object about which a person has feelings and beliefs. Attitudes can be changed. It can fall anywhere on a continuum from very favorable to very unfavorable. It is true – Attitude determines your altitude. Attitude is the Game changer in the adoption process. A favorable attitude to change is required by the organizations to respond to threats in the environment. An organization with a favorable attitude perceives the threat as an opportunity for improvement. An Organization without a positive attitude self-destructs (Nechully and Pokhriyal, 2019).

The management of organizations should have a favorable attitude towards Innovator, innovation opportunities, innovative technologies, and employees who come up with innovation. The deserving credits should be given to the employees coming up with innovative ideas – The employees should have a feeling that they will be heard and recognized for good suggestions. Favorable Organizational Attitude can motivate employees to search for innovation opportunities in the organization. Skeptical attitude – To view innovation always with suspicion, discourages the employees. A favorable attitude toward the brand/technology or Distributor speeds up the contract finalization process and Implementation. A positive attitude towards innovation encourages the organization to mobilize funds, organize training programs, and make necessary infrastructure arrangements. The cooperation of employees is required for procedural changes or changing the existing systems/infrastructure in the organization. Only employees with a favorable attitude towards innovation will cooperate wholeheartedly (Nechully et al., 2019b). A favorable attitude from the organization is very much required to inculcate a favorable attitude in the minds of employees towards utilization of adoption. Many organizations in Oil and Gas have attitudinal problems towards innovation. Favorable attitude helps to overcome the normally encountered barriers to the utilization of innovation (Nechully et al., 2019d).

10.3.2 ORGANIZATIONAL READINESS

Organizational readiness conveys the willingness and ability to accept change. Organizational readiness conveys the preparedness on the part of an organization to embrace changes. Organizational readiness also reflects the confidence level of organizations to adopt and implement innovations. The confidence of an organization increases if it has sufficient resources in terms of infrastructure and skill set (Nechully and Pokhriyal, 2019). Organizational Readiness implies not only resources but also an Innovation climate and an Innovation culture. Organizational readiness helps to create a winning attitude – when innovation, resources, and objectives are perfectly aligned

A hostile environment discourages employees from searching for innovation opportunities — only a well-prepared organization with conditions conducive for innovation adoption encourages employees to search for innovation opportunities. An Organization without a culture of innovation cannot encourage its employees to search for innovation opportunities (Nechully, Pokhriyal and Thomas, 2018a). Organizational Readiness also implies a change in approach from the top management regarding innovation activities (Nechully et al., 2019a). Top management can contribute a lot to organizational readiness by allocating sufficient resources. The organization always goes for a technology which it is capable of adopting in the organization. To pursue a technology – far beyond the capabilities of an organization is a mad waste of time, or the organization should have the confidence to make the necessary changes for adoption. It is not only infrastructure and skilled workforce, but also, at times, sufficient budgets will not be available. Timely allocation of budgets is also very important. While evaluating the contract, the "Organization Readiness Factor" comes in to play (Nechully et al., 2019c). The organization will not give the contract to a vendor whose technology it cannot implement. The organization should be ready with the necessary procedural changes, infrastructure, and training programs for skill set enhancements. Communicating Organizational readiness to all concerned

departments involved in the adoption process speeds up contract finalization. Lack of organizational preparedness delays the implementation and utilization of innovation. The organization should have competent employees and related infrastructure for the implementation and utilization of innovation (Nechully, Pokhriyal and Thomas, 2018b).

10.3.3 INTENTION TO USE

Intention to use is "Where, When, how, and by whom" to use the innovation also affects the utilization of innovation (Nechully, Pokhriyal and Thomas, 2018a). Future usage of technology in an organization depends on the Usage intentions and Purchasing Intentions. Intention to use signifies the willingness to utilize innovation. Whenever the intention changes, technology usage also changes (Nechully and Pokhriyal, 2019).

Higher the intention, more chances that the employees will utilize innovation in the field/organization. In fact, "Intention to use" helps the organization to formulate a "Technology usage strategy." Lack of clear cut intentions delays the utilization of innovation. Innovation can be utilized properly if and only if the organization is crystal clear about the utilization of innovation Enlightening the end-users about the benefits of usage enhances the utilization of innovation in an organization (Nechully et al., 2019d).

10.3.4 RE-PURCHASE/SUBSTITUTION/NEW PURCHASE

Purchasing decisions often influence future usage decisions. Either the purchase initiatives come from the end-users, or it comes directly from the top management. Purchasing decisions might be due to the marketing efforts of the innovator or according to the market trends. The purchase decision determines what technologies are to be adopted and utilized in the plant (Nechully, Pokhriyal and Thomas, 2018d). What type of technologies to be purchased or whether to continue using the same technology decides future technology usage decisions.

The end-user continues with the usage or Re-Purchase an innovation if he is happy with the results, and there are no advanced alternatives available in the market (Nechully and Pokhriyal, 2019). The end-user substitutes the innovation when there is an advanced alternative available in the market. The end-user makes a new purchase when the application itself becomes irrelevant or when innovation disrupts the market. In that case, the organization abandons the opportunity, and new opportunities relevant to the organization are focused upon (Nechully et al., 2019a). New technologies are selected to exploit the new opportunities.

10.3.5 ORGANIZATIONAL INNOVATIVENESS

Organizational innovativeness reflects the orientation of the organization towards innovation. Organizational innovativeness is nothing but the willingness and commitment to change – without which Organizational readiness is not possible to achieve (Nechully, Pokhriyal and Thomas, 2018c). A firm with high innovativeness searches for ways to enhance its organizational readiness to adopt innovations. An organization lacking "Innovativeness" cannot adapt to the changing environments. Organizational innovativeness helps to find the inefficiencies in the organization and to make necessary changes to eliminate the inefficiencies (Nechully et al., 2019c). Organizational innovativeness encourages organizations to regularly review the existing technologies and processes and scan for better alternatives (Nechully and Pokhriyal, 2019). Only a company with an orientation or inclination towards innovation will prioritize and channelize resources for innovation. In a competitive environment, organizational innovativeness helps to achieve competitive advantage (Nechully, Pokhriyal and Thomas, 2018d). To create the necessary competitive advantages, the organizations should have sufficient resources – infrastructure, skill set, and Budgets (Nechully et al., 2019d).

10.3.6 ORGANIZATIONAL CULTURE

Organizational culture defines how an Organization behaves or responds to external challenges. An organization requires a culture of innovation to survive in a competitive market. Organizational culture defines the overall functioning of an organization. It describes the shared assumptions about how an organization should operate (Nechully, Pokhriyal and Thomas, 2018b). It guides the behavior of the employees. Organizational culture defines what the organization is all about, what it wants to achieve in the future, and how it should operate to achieve future goals (Nechully et al., 2019c). Organizational culture helps an organization to prepare itself for changes in the market by introducing new procedures/systems or technologies. Organization culture is the "Personality" of the organization. Organizations can correct many of the problems by changing the culture. Culture guides the transition of the company (Nechully and Pokhriyal, 2019).

Organizational culture also affects the Organizational Readiness. Without a culture of innovation, the organization cannot prepare itself for change. The culture of an organization is something which has evolved over the years and difficult to change. Organizational climate and Organizational customs influence Organizational Culture (Nechully, Pokhriyal and Thomas, 2018b). Organizational culture comes from the various past experiences of the organization. Only an organization with a Culture of innovation seeks opportunities for improvements (Nechully et al., 2019a). Innovative Organizations allocate Resources and make internal changes to embrace promising innovations. An "Innovative organization" can change itself /adapt itself according to different scenarios. It is always eager to explore ways to enhance efficiency. An innovation culture encourages employees also to change and to search for better ways of doing things (Nechully et al., 2019b).

10.3.7 TOTAL EFFORT

Expectations of efforts influence the attitude formation towards an innovation. End-users prefer to use an innovation which requires only minimum efforts to

operate (Nechully, Pokhriyal and Thomas, 2018d). Minimum efforts and maximum gains cultivate a favorable attitude towards innovation. End Users prefer Technologies which are easy to learn, use, and maintain (Nechully et al., 2019b).

10.3.8 PERCEIVED USEFULNESS AND BENEFITS

The usefulness of innovation to an organization helps to develop a positive attitude. The perceived usefulness enhances the favorable attitude towards innovation. Usefulness can be in the form of reduced operating costs, increased efficiency, job performance, and revenue generation (Nechully et al., 2019c). The usefulness of the technology enhances confidence about the ROI and creates a favorable attitude towards innovation (Nechully and Pokhriyal, 2019). Any innovation capable of giving quantifiable results enhances a favorable attitude towards it.

10.3.9 SCIENTIFIC CREDIBILITY

Oil and Gas cannot afford to experiment with unproven technologies – Either the innovator should prove the credibility during field trials in the same sector, or other relevant sectors (Nechully, Pokhriyal and Thomas, 2018a). Failures can be catastrophic. The credibility of technology enhances the favorable attitude towards it. At times, Scientists do not believe in the credibility of technologies outsourced for development, and this lack of credibility can delay the adoption or can lead to non-adoption (Nechully et al., 2019d).

10.3.10 AFFORDABILITY

An organization will not pursue an innovation – which it is not capable of buying. The end user will not go for a technology for which he is sure – will not be approved due to lack of budget. So a favorable feeling is developed towards affordable Technologies (Nechully et al., 2019b). The affordability of innovation creates a favorable attitude towards innovation. If the innovation is not affordable –

way beyond the budgets of oil and gas companies – it creates a mental block in the minds of decision-makers (Nechully, Pokhriyal and Thomas, 2018b).

10.3.11 ICV SCORE

ICV score is something unique to UAE Oil and Gas. It measures the value contributed to the UAE economy by companies in the UAE (Nechully, Pokhriyal and Thomas, 2018c). ADNOC prefers to deal with companies having high ICV score (Nechully et al., 2019c). ADNOC gives the company with the highest ICV score a chance to meet the best tender terms in terms of delivery, price, etc. ADNOC prefers to deal with vendors or manufacturers, making a substantial contribution to the UAE Economy (Nechully and Pokhriyal, 2019).

10.3.12 COUNTRY OF ORIGIN

UAE Oil and Gas prefer products or technologies from US/UK/Europe. There was a time when – these oil and gas companies categorically specify in their tenders – "Asian Products not accepted." There was a time when the quality of US/UK/European products was unmatched by Asian manufacturers (Nechully, Pokhriyal and Thomas, 2018b). But now the scenario has changed. Even the Asian manufacturers are quality conscious right now. They provide quality innovations at an affordable rate. Moreover, there are many startups in Asian countries coming up with promising innovations (Nechully et al., 2019b). So, Oil and Gas companies should do away with "US/UK/European bias" when it comes to "Innovative Technologies Selection."

10.3.13 LOCAL PRESENCE

Local presence creates a favorable attitude towards innovative technologies. In ADNOC – if the innovator does not have a local office or another local partner, it cannot take part in many tenders. Local presence for aftersales support enhances the favorable attitude (Nechully, Pokhriyal and Thomas, 2018a). The entry to Oil

and Gas sites requires special passes issued by the government. The Special Passes are given only to persons with Abu Dhabi Visas or Missions visas (Nechully et al., 2019b).

10.3.14 ABSORPTIVE CAPACITY

Absorptive capacity refers to the ability to learn new things. It describes the learning skills of an organization. Only a learning organization can survive in this competitive scenario. The ability to learn enhances Organizational innovativeness (Nechully, Pokhriyal and Thomas, 2018c). Organizations need the ability to analyze the innovations available in the market to select the appropriate one(s). Acquiring knowledge is one of the strategies to tackle the insecurity prevailing in the market today (Nechully and Pokhriyal, 2019). For acquiring the knowledge, the organization should have the ability to learn new things, and this learning capacity creates an orientation towards innovation. So, learning capacity is required to enhance the innovativeness, without which an organization cannot survive in this competitive market (Nechully et al., 2019b).

10.3.15 INFORMATION

Relevant, timely, and trustworthy information enhances the curiosity of the end-users. An innovator should never overload the organization with information. Information overload leads to total confusion (Nechully, Pokhriyal and Thomas, 2018b). Access to relevant information enhances organizational innovativeness. Partnership with other companies helps to acquire information about the latest technologies. If relevant, partnerships are formed to develop innovation as a partnership venture (Nechully et al., 2019a). The information about the latest technologies enhances the innovativeness of organizations. The right information helps to evaluate innovation suitability. Information builds the initial confidence in the innovation (Nechully and Pokhriyal, 2019). The information should be sufficient enough for the organization to make a decision. Information should help

the organization to compare technologies. Organizations should identify trustworthy sources of information (Nechully, Pokhriyal and Thomas, 2018d).

10.3.16 PATTERNS OF PURCHASE

Patterns of past purchases orient the organizations towards a particular line of purchasing. The organization should not get locked to a particular line of technologies. Based on past purchases, Organizations become biased to certain technologies or vendors which limit their exposure to other innovations (Nechully et al., 2019d). Organizations should adopt whatever is beneficial to them. The purchasing patterns orient organization towards certain technologies for certain applications and certain vendors for certain technologies (Nechully, Pokhriyal and Thomas, 2018a).

10.3.17 FACILITATING CONDITIONS

Any innovation, which is proposed to be adopted, requires the presence of some minimum basic conditions in the organization or plant. Facilitating conditions of an organization play a significant role in enhancing innovativeness (Nechully, Pokhriyal and Thomas, 2018b). The constraints imposed by the actuals conditions within the organization introduce an element of practicality into the organizational views – The organization inclines towards those technologies which they can implement easily within the constraints of facilitating conditions of an organization (Nechully et al., 2019d). The organizations should have a clear cut idea regarding the resources – workforce, budgets, technological infrastructure, etc. which facilitates the innovation adoption. Management support, competent workforce, Organizational Priorities, etc. influence the willingness of the organization to experiment with innovative technologies (Nechully et al., 2019a). Without proper facilitating conditions, employees will not feel motivated to search for innovation opportunities because they feel it will be a useless pursuit.

10.3.18 ORGANIZATIONAL CUSTOMS

Customs are deep-rooted accepted ways of doing or executing things in an organization – followed by the organization for years. Customs dictate how an employee reacts or behaves in a particular situation in an organization (Nechully et al., 2019c). It is extremely difficult to change the customs of an organization. "Beliefs, values and norms" – contributes to the formation of customs in an organization. Organizational culture is also affected by Organizational customs. The changing of customs helps gradually change the organizational culture. Customs are the accepted norms of behavior in an organization. It reflects the appropriateness of behaviors on certain occasions –Employees should behave only in particular ways in certain situations. Certain customs will create roadblocks in the process of cultivating a culture of innovation (Nechully, Pokhriyal and Thomas, 2018c). Customs are deep-rooted in organizations and are not recorded in any official documents. Changing Customs of an organization is not an easy task. The majority will resist these changes. So to change customs – either organization have to change (1) Routines or (2) Norms or both (Nechully and Pokhriyal, 2019). To change the customs, either the organization has to modify the acceptance levels of the customs or to modify the existing processes or replace it with new ones by convincing the appropriateness of the new ones in the current organizational context to the employees.

10.3.19 ORGANIZATIONAL CLIMATE

Organizational climate refers to the perception of the employees about the working environment in the organization. An organization without a creative work environment will not survive. A stimulating working environment is required to come up with innovative ideas (Nechully et al., 2019a). Appreciation for good work in the workplace, reward systems, general management attitude towards employee's problems, etc. contributes to a positive feeling about the work environment (Nechully et al., 2019d). A good organizational climate

encourages creativity in the workplace and helps to maintain a very healthy work environment. After all, the perceptions make all the difference. Workplace perceptions influence the culture of an organization. How you work in the office, how you interact, the facilities available for recreation, rewards, etc. describes organizational climate - Organizational climate affects the organizational culture. Organizational culture defines how the organization functions. For an organization to understand the culture, it is important to know what is happening in the workplace. Changing the organizational climate is easy (Nechully et al., 2019b). It can be done by the immediate supervisors or by the management. Changing Organizational climate, in fact, many of the department-specific climates are the stepping stones to changing organizational culture. Accumulation of experiences in the workplace influences the culture of an organization (Nechully, Pokhriyal and Thomas, 2018a).

10.3.20 DECISION STYLES

Decision-making styles affect the Intention to use. A bottom-up – participatory approach in decision making creates a feeling of "being a part" of the process. Participatory decision making enhances the commitment of usage from the end-users - to use innovation for the benefit of the organization (Nechully, Pokhriyal and Thomas, 2018c). Decision-making styles are important in oil and gas as the decisions can have a profound influence on the bottom line (Nechully et al., 2019a). Relevant information regarding the operations of the company is very vital for decision making. The organization will get certain information about the hard realities if and only if it involves the relevant personnel in the decision-making process (Nechully and Pokhriyal, 2019). So a bottom-up decision making can be very effective in oil and gas. End users will utilize innovation and make sure that it is benefitting the organization as they do not want a bad result for a decision taken by them.

10.3.21 AFTER-SALES SUPPORT

After sales support is an important variable affecting usage intentions. Continuous support is required to keep the technology running. When the end-users are using a new product – doubts are bound to arise, and if the innovator fails to provide necessary assistance to clear these doubts, the end-users will postpone the usage (Nechully et al., 2019d). End users expect the innovator to provide quick and reliable after-sales support. Lack of continuous support creates a negative feeling in the minds of end-users and ultimately leads to usage reluctance or even premature abandonment of the innovator and the innovation. Selection of innovator should be made based on whether they have sufficient resources to provide 24 x 7 supports (Nechully et al., 2019c). The Researcher divides Aftersales support into two categories of (1) Aftersales services and (2) Tech support. After-sales support in clearing the technical concerns and providing other services like calibration, warranty services, etc. enhances the intention to use. History of Poor after sales support discourages end-users from utilizing innovation. Poor aftersales support for one product affects the decisions regarding other products from the same innovator (Nechully and Pokhriyal, 2019). Innovators can give aftersales support through Call Centers - After Hours Telephone Answering Service, Work Alone Service, Emergency Response Service, and Virtual Receptionist (Nechully, Pokhriyal and Thomas, 2018b).

10.3.22 HYPE CYCLES

The hype regarding a technology – Overestimation of technology benefits, intensifies the Intention to use. But when the end-user realizes the actual benefits, it reduces the "usage intentions." Many a time what happens is that the optimism exaggerates the technology benefits. There is "over expectation from the innovation'," and this overestimation of benefits encourages end users to use the innovation (Nechully, Pokhriyal and Thomas, 2018a). Failure to meet these expectations leads to disillusionment and premature abandonment. Hype cycles encourage end-users to utilize innovation belonging to particular trends (Nechully et al., 2019a). When the whole industry is behind a particular trend, the end-users

of a particular company cannot be left behind. Hype cycles create an enthusiasm to utilize particular trends in the industry. A word of caution - before utilizing these trends, the suitability for particular applications has to be evaluated (Nechully, Pokhriyal and Thomas, 2018c).

10.3.23 USER SATISFACTION AND TRUST

"Results of Utilization" affects User Satisfaction and Trust, and it changes according to the results of utilization. Our earlier experiences also contribute to the initial trust placed on the innovation or brand. User Satisfaction and Trust contributes to Intention to usage. When the reliability of the results starts getting affected, the intention to use also changes (Nechully, Pokhriyal and Thomas, 2018d). Erroneous results - result in the loss of trust. The results from the previous innovations from the same brand build the trust (Nechully and Pokhriyal, 2019). Once end-users trust a brand, then it becomes easy to elicit user satisfaction. An end user will be very reluctant to use a brand he does not trust. An end-user places more trust in an innovator who has a history of successful innovation (Nechully, Pokhriyal and Thomas, 2018a).

10.3.24 COMPLIANCES

Statutory and Industry standards compliances also influence innovation usage intentions. The problems with some of the technologies are that there are no predefined standards available in the industry. So organizations have to create their standards or outsource the task to a third party (Nechully and Pokhriyal, 2019).

10.3.25 CUSTOMIZATION AND COMPATIBILITY

The innovation should be customized to meet the specific applications of the plant, and it has to be compatible with the existing infrastructure or with minor modifications to the existing infrastructure (Nechully et al., 2019d). Organizations

have to search for customized innovation compatible with their systems. Customization to the exact requirements and Compatibility with local conditions enhances the Intention to Use (Nechully, Pokhriyal and Thomas, 2018b).

10.3.26 RESISTANCE TO CHANGE

Resistance to change also affects the Intention to use. End users comfortable with a particular technology and lack self-confidence to master new technologies block the usage of innovations in the organizations (Nechully et al., 2019c). Resistance to change decreases the tendency to experiment with new technologies. The risk factor involved and Confidence to learn new technologies affect the usage intentions of employees. Resistance to change should be lowered to amplify the usage intentions (Nechully et al., 2019b).

10.3.27 TECHNOLOGICAL ADVANCES AND ALTERNATIVES

Technology advancements along a particle line of technology influence the purchase decisions. Technical advances can be of two types – incremental improvements or disruptive innovations in a particular field – an entirely new technology (Nechully et al., 2019c). Incremental improvements create "intergenerational alternatives" and disruptive innovation causes "completely different alternatives" (Nechully and Pokhriyal, 2019). Technological advances at times are so fast that the technologies become obsolete very soon. There are no sufficient time gaps between the generations of the same technologies – which creates intergenerational competitions. Technological advances come from within the industry or from other industries (Nechully et al., 2019d). In some cases, due to technological advances, the existing procedure/practice itself becomes irrelevant or outdated.

10.3.28 RE-INVENTION

Re-Invention occurs when the end-user or innovator finds different usages for the innovation or different methods of usage for the same problem. At times, manufacturer of technology on the verge of obsolescence "Re-Invents" to boost the sales by adding new applications or features to the existing ones (Nechully et al., 2019c). Re-invention creates a tendency to prolong the use of the existing technology. Sometimes – the Re-Invention initiative comes from the end-users to prolong the scrapping of the existing technologies with which they are extremely comfortable. The organization has to gauge the benefits of the "Re-Invention" against the "benefits from the innovation" – often missed or delayed due to Re-Invention (Nechully et al., 2019a). Most of the times, Re-Invention from the innovator side happens due to feedback from the field by the end-users (Nechully, Pokhriyal and Thomas, 2018d).

10.3.29 TRADE UP OR BUY BACK

Obsolete technology has no value in Oil and Gas for Re-Sale. So Re-Sale Value never contributes to purchase decisions. But Trade up, and Buyback schemes for a certain percentage of original cost or at a predetermined price encourages organizations to exchange the technology for an upgraded or advanced version (Nechully, Pokhriyal and Thomas, 2018a). Trade up, or buy-back schemes help organizations to speed up adoptions by exchanging existing one for an advanced one - for a comparatively small amount (Nechully et al., 2019d)**.** Organizations can include Trade Up/Exchange Schemes in the Contract itself. The innovator is liable to either upgrade or supply the latest innovation as an exchange for the obsolete technology. Trade up or buyback creates lot of cost savings for the organization rather than dumping obsolete technology (Nechully and Pokhriyal, 2019).

10.3.30 BRAND LOYALTY

Many Organizations falls into the trap of "Brand loyalty." The organization considers innovation from certain brands or a certain brand only for a particular application(s). Brand loyalty prevents organizations from adopting innovation from Non-Loyal Brands. Brand loyalty limits the options for organizations (Nechully et al., 2019c). Brand Loyalty is good for innovator but not for adopting organizations. Brand loyalty influences purchase decisions. Brand loyalty leads to continued usage and repurchase.

10.3.31 INDUSTRY TRENDS

Industry-specific trends also create Hype cycles. Industry Trends are there in Oil and Gas – right from the discovery of oil by Bissel and Drake in 1859. There are times when the whole industry is after a particular trend, and this creates an exaggeration of benefits – a hype regarding the technology. Organizations should evaluate Industry trends before adopting them. These trends can come from other industries, as well (Nechully et al., 2019a).

10.3.32 OPTIMISM

There is always optimism regarding the innovative technologies in the oil and gas industry. This optimism creates hypes around certain technologies (Nechully et al., 2019d). The benefits of technology are exaggerated. These exaggerations cause the whole industry to pursue it – without actually understanding the pros and cons of an innovation (Nechully and Pokhriyal, 2019). Organizations should evaluate Technologies thoroughly before adopting it in the plant - not to get influenced by the hype. Optimism regarding a technology results in over expectations from innovation but these expectations might be far from realities. Optimism gives way to Exaggeration of Benefits and causes Hype cycles (Nechully, Pokhriyal and Thomas, 2018c).

10.3.33 SELF-EFFICACY

Self-efficacy is the "Self-confidence" to deliver a certain level of performance. In most of the cases, the end-users are skeptical – Whether they can master the usage of innovation Lack of self-confidence creates the Fear of change (Nechully, Pokhriyal and Thomas, 2018d). An oil and gas company has to enhance its self-efficacy to meet the market uncertainties or tackle the risks by committing enough resources. Enough resources build self-efficacy of organizations (Nechully et al., 2019b). Lack of skill set or lack of confidence to learn new things also causes resistance to change.

10.3.34 UNCERTAINTY/RISK

The oil and gas market is very risky and uncertain. Nobody can predict what will happen in the future for oil and gas. So the oil and gas companies should be prepared to face the worst (Nechully, Pokhriyal and Thomas, 2018a). E&P companies invest millions of dollars every year to explore prospective fields. So any innovation which can reduce this element of risk – which helps in E&P are always welcomed in Oil and Gas (Nechully et al., 2019c). The risk is very high in oil and gas as each innovation decisions might involve millions in investment (Nechully and Pokhriyal, 2019). There should be no margin for errors in oil and gas. Oil and Gas has an innate tendency to reduce uncertainties. Oil and Gas want the minimum or zero risks in their operations. Changing a system giving good results to something which organizations are not sure of performing well – There is an element of risk or uncertainty involved. So risk/uncertainty element affects the innovation decisions (Nechully et al., 2019a).

10.3.35 SATISFACTION WITH OLD PRACTICES

The main reason for resistance to change is "Satisfaction with the Old practices." The end-users become so comfortable with the existing system to the extent that they do not want to come out of their comfort zone to learn new things, even if the innovation gives them better results (Nechully, Pokhriyal and Thomas, 2018b).

Another reason for the reluctance to change is due to the satisfactory results given by the existing system. End users do not want to change a system giving them good results (Nechully, Pokhriyal and Thomas, 2018c). The question which influences the innovation adoption is – Is there an urgent need to change the existing technologies giving good results in the plant? (Nechully and Pokhriyal, 2019).

10.3.36 SOURCES OF INFORMATION

Various sources of information are (1) Advertisements (2) Social Media (3) Success Stories/Product Reviews (4) Referrals (5) Technical Journals/Magazines (6) Customer Specific Presentations/Seminars/Workshops (7) Partnerships – Innovation Cooperation (8) Oil and Gas blogs (9) News Sites (10) Corporate Blogs (11) Conferences, Tradeshows and Exhibitions (12) Universities or national and international research institutes or Regulatory agencies (13) Vertical linkages including suppliers, customers and competitors, (14) Patent disclosures (Nechully et al., 2019a).

10.3.37 AFTERSALES SERVICE

After Sales Service for innovative technologies includes training on the use of the product, updates for software, calibration services, scheduled maintenance or provisions of materials or parts, repair and servicing, money-back guarantees, or warranties for replacement in case of damage or defects (Nechully et al., 2019c).

10.3.38 TECH SUPPORT

The end-users expect 24 x 7 Technical supports, especially in an industry like oil and gas (Nechully et al., 2019d). Innovators can provide Technical support through Technical Support/Help desk, online knowledge bases like forums, and Automated Customer Service (Nechully and Pokhriyal, 2019). Tech support consists of responding to the technical queries 24 x 7. End users expect 24 x 7

Tech support through online or through emails or call centers/telephone. Non-response to Technical queries irritates end users (Nechully, Pokhriyal and Thomas, 2018b).

10.3.39 FAMILIARITY

Familiarity with a brand helps to speed up the prequalification process. Familiarity with a particular brand or Vendor influences the purchasing patterns. Familiarity builds the initial rapport or relationship, which creates a favorable environment for adoption (Nechully, Pokhriyal and Thomas, 2018a). But an organization should not get locked along some particular lines of technologies due to History of past purchases or Familiarity. Familiarity with a particular vendor or technologies also creates these kinds of "orientation traps." These "orientation traps" occurs unconsciously (Nechully et al., 2019c). An organization should not always depend on a familiar set of vendors. They need to turn to other new vendors as well for increasing their options.

10.3.40 HISTORY AND FREQUENCY OF PAST PURCHASES

History and Frequency of past purchases incline organizations towards certain technologies or certain vendors. Organizational Bias is not created consciously, but it happens. History and Frequency of previous purchases made affect the purchasing patterns in an organization (Nechully et al., 2019a). The Frequency of Past purchases embeds this "Behavior" to Organizational memory. History and Frequency of purchases creates a bias towards certain technologies or vendors (Nechully and Pokhriyal, 2019). There are instances of organizations getting locked along certain lines of purchases for similar requirements. At times the organizations get the best innovations from small companies (Nechully, Pokhriyal and Thomas, 2018b).

10.3.41 COMPLEXITY

Complexity enhances the perception of requiring more efforts to be put in for learning and usage. A feeling of complexity of innovation creates mental blocks in the minds of executives and end-users. It prolongs the implementation and increases the cost. Perfect positioning of innovation to the employees is required to reduce the perception of complexity (Nechully, Pokhriyal and Thomas, 2018a). The perception of complexity about the technology makes the implementation and utilization of innovations difficult in an organization. Innovators can reduce complexity by having an innovation strategy in place (Nechully et al., 2019b). It should address "Who, When, What, Where and Why of implementation problems."

10.3.42 EASE TO LEARN AND USE

Ease to learn and Ease of use are very closely related concepts. So the researcher merges both to a single variable called "Ease to learn and use." Ease to learn and use contributes to the total efforts put in by the end-user. Many important innovations are not used frequently due to the effort required to learn and operate it (Nechully et al., 2019a). Innovation should not only meet the user requirement, but it should also be easy to learn and use. "Ease to learn and use" reduces the total effort and enhances the propensity to experiment with the innovation (Nechully and Pokhriyal, 2019). The researcher combines ease of installation, usage, and maintenance to a single variable "Ease of use." The researcher combines Ease to get information and Ease to learn to a single variable Ease to learn. A technology which though extremely difficult to use, but still gives the best results, in that case, the end-user will abandon the innovation for a technology that gives the same results with less effort (Nechully, Pokhriyal and Thomas, 2018c).

10.3.43 USER EXPERIENCE

User Experiences contributes to Satisfaction and Trust. User satisfaction can be divided into two (1) Previous experiences with the vendor (2) Current experiences. (View 1) Prior Experiences with the innovator creates an initial good impression about the innovator, and this creates an environment conducive for the creation of satisfaction and trust (Nechully et al., 2019d). There is a contradictory view regarding prior experiences. (View 2) The supporters of this view propose that "Initial Bad experiences" reduces the expectations and "Initial Good experiences" enhances the expectations. In Oil and Gas, Organizations do not experiment with an innovator whose technologies have not given the expected results (Nechully, Pokhriyal and Thomas, 2018b). View 1 Prevails. The end users repurchase an innovation if the experiences with the usage are pleasant. The results derived from the earlier usages of innovation from the same brand also contribute to the trust and initial impression. This initial impression creates a favorable environment for enhancing satisfaction and trust (Nechully and Pokhriyal, 2019).

Experiences during usage also affect satisfaction and trust. Failure to give consistent performance and results – leads to dissatisfaction and mistrust. Experiences during usage – enhance or diminish the satisfaction (Nechully et al., 2019c). Usage Experiences play a crucial role. Organizations abandon some of the best innovations in due course of time due to bitter user experiences.

10.3.44 PRODUCTION TIMELINESS

Timely production completion and delivery also contribute to trust and satisfaction. Delayed deliveries undermine the smooth operations of the plant. Reliable delivery times count a lot in oil and gas (Nechully, Pokhriyal and Thomas, 2018a). There might be many operations scheduled ahead based on the delivery commitments of the vendor. Any deviation from this commitment creates a bad impression about the brand, and this, in turn, gets reflected on the innovation as well (Nechully et al., 2019c).

10.3.45 BELIEFS AND EVALUATION OF OUTCOMES

The innovation should be able to deliver the expected results. If there is any mismatch between the expected and the actuals – its causes dissatisfaction (Nechully, Pokhriyal and Thomas, 2018b). Dissatisfaction causes loss of trust. In short, an innovation should deliver "What it has promised."

10.3.46 MARKET STRUCTURE AND COMPETITION

The competition in the market encourages companies to learn new things. Unfortunately, in oil and gas, there is no competition. Oil and Gas is an Oligopolistic market where the oil-producing countries have formed OPEC and get huge profit margins by sharing the market and deciding on the prices. There are no incentives to learn new things (Nechully et al., 2019a). Now the profit margins are decreasing, and competition is increasing from alternative sources. Oil and Gas do not face competition from within, but they face competition in the international energy market from various sources of energy (Nechully and Pokhriyal, 2019). So to remain competitive, Oil and Gas has to learn new things. So Market Structure and Competition influence the learning capacity.

10.3.47 R&D

R&D enhances the learning capacity of organizations. R&D act as eyes and ears of organizations in the market. R&D can also act as an intermediary between Research Institutes and Plant Operations (Nechully, Pokhriyal and Thomas, 2018b). It can check the practical feasibility of Laboratory tested prototypes in the actual fields. A focused R&D department can review the operations regularly and can search for improvement opportunities. Strong R&D helps to keep abreast of things happening in the market. It also helps to develop solutions internally (Nechully, Pokhriyal and Thomas, 2018a). There should be somebody in the organization to think out of the box for Oil and Gas companies. Employees like

engineers and other admin staff will be too busy in their day to day activities and if the organization has a strong R&D – they can bring in "Out of the box" ideas (Nechully et al., 2019b).

10.3.48 CEO AND EMPLOYEE INNOVATIVENESS

CEO and Employee Innovativeness positively influence learning capacity of organizations. The curiosity of the CEO and Employees to learn new things is called Innovativeness. Without the willingness on the part of Management and Employees to embrace adoption – the organization will never prosper (Nechully et al., 2019b). CEO Innovativeness can create a difference. A visionary CEO, who likes to experiment with innovation, is a blessing for any organization. They will be always on the lookout for improvements and enhances the learning capacity of an organization. Support from somebody as high as CEO – enhances the learning abilities of an organization (Nechully, Pokhriyal and Thomas, 2018d). It enhances the innovativeness of the employees as well. Employee innovativeness plays an important role in suggesting the right innovations for their applications (Nechully and Pokhriyal, 2019). Employees should be encouraged to scan for innovation opportunities in the organization. Only a CEO who is receptive to innovative ideas and encourages employees also to generate innovative ideas can guide an organization through the downturn.

10.3.49 ORGANIZATIONAL OPENNESS

In a competitive energy market, – an organization should be open to everything. Otherwise, it is doomed to become a failure. If it is not open to the latest developments in the market, it cannot learn new things and change**.** Organizational Openness enhances the learning capabilities of an organization (Nechully et al., 2019d). Openness helps to review past mistakes and to take corrective actions. Organizational Openness – keeping an open approach to the market help organizations to self-evaluate – to benchmark against the competitors

or market standards. Organizational openness enhances the absorptive capacity of an organization by embracing learning opportunities from within and the surroundings (Nechully, Pokhriyal and Thomas, 2018c). Only an Open organization can survive in this highly competitive market. An organization should be open to everything – Good or Bad Feedback from the market, changing trends, competition, innovations, developments in other markets, etc. Only an open organization can understand the pulse of the market (Nechully et al., 2019c). Organizational openness should start in the house – An organization should always listen to suggestions from employees.

10.3.50 PRICE, SWITCHING COST AND BUDGETS

Organizations will not waste time on unaffordable innovations. The buying price of innovation affects affordability. Buying price should always be lower than the budget allocated for innovation (Nechully et al., 2019c). Implementation cost is nothing but "Switching cost." The expenses to change from one technology to another are called Switching cost. The buying cost + switching cost should be lower than the allocated budgets (Nechully and Pokhriyal, 2019). Keeping the switching cost higher is a strategy adopted by the innovator to avert the possibility of replacing the existing technology with better technology from a different brand. So either the technology selected should be of lower switching cost or the necessary switching cost required can be factored into the budgets (Nechully et al., 2019b). At times, what happens is that the time delay in releasing the RFQ might have resulted in an escalation of prices. The budget allocated might be lower than that of the cost components, and the organization will have to restart the process. The cost components to be considered while deciding the budgets are the cost of innovation, cost of installation, commissioning, and training, warranty, spare parts, and cost of maintenance (Nechully, Pokhriyal and Thomas, 2018c).

10.3.51 COST SAVINGS AND PROFITABILITY

Cost-saving and profitability enhance the usefulness of the technology. Cost-saving and profitability can be both short terms and long term. But some of the organizations are myopic. Some of the innovative technologies will not give short term results but will be giving wonderful results in the long term (Nechully, Pokhriyal and Thomas, 2018a). Any innovation which can enhance the profitability, in the long run, should be adopted. Especially in this downturn – Oil and gas are looking forward to embracing technologies that can reduce cost and enhance profitability (Nechully et al., 2019d).

10.3.52 ENHANCED JOB PERFORMANCE

An end-user is particularly interested in technology if it enhances his job performance in the plant. The end-user always prefers innovation, which helps in the performance enhancement. "Performance Enhancement" creates a big influence when it comes to the utilization of innovation (Nechully, Pokhriyal and Thomas, 2018d). The end-user should be able to perform his job to the satisfaction of his superiors — best results in the minimum time. Job Performance enhances his chances of getting a promotion, Salary hikes, etc. There are two perspectives on Usefulness which should be taken into account while studying the innovation adoption - Usefulness to Organization and Usefulness to Employees (Nechully et al., 2019a). Innovation will be useful to an organization if it reduces cost and enhances profitability. But this fact might not be a motivating factor for an employee to use it. For him – it has to enhance his job performance (Nechully and Pokhriyal, 2019).

10.3.53 ENVIRONMENTAL BENEFITS

Environmental Friendliness of the technology or any innovation which reduces the footprint - very much welcomed in Oil and Gas. Environmental Friendliness of operation is not only a statutory requirement but also a commitment to society – for the generations to come. Nowadays, the society in which the organizations

operate is environmentally conscious (Nechully et al., 2019b). The innovation has to deliver some environmental benefits compared to the existing technologies. The whole oil and gas are behind technologies, which reduce adverse environmental impacts. The environmental commitment shown by the organizations enhances the reputation in the market (Nechully, Pokhriyal and Thomas, 2018c).

10.3.54 TIME BUDGETS

Time budgets – Getting things done in minimum time is important in Oil and Gas. Any innovation which reduces the duration of the process is something which will be favorably looked at by oil and gas companies (Nechully et al., 2019a). Time is money, and any time saved is money saved. All activities in Oil and Gas have time budgets. Technologies which can give results or which can help the employees to execute activities in minimum time are preferred – "Results in minimum time." So - time budgets affect the usefulness - The actual "Processing time" – counts a lot in oil and gas (Nechully et al., 2019d).

10.3.55 SAFETY

Organization prefers to adopt an innovation which enhances the safety of workers by reducing the number of mistakes or errors. Organizations accord topmost priority to Safety (Nechully, Pokhriyal and Thomas, 2018b). The margin for errors is very small in oil and gas, or the results will be very catastrophic. Innovation should enhance the overall safety of the processes and personnel (Nechully et al., 2019b). So the safety aspect of innovation enhances the usefulness of innovation for an organization. All innovative products and processes should be 100% safe.

10.3.56 SECURITY

Organizations prefer to maintain the Confidentiality of the plant information. A huge amount of relevant information is generated, processed, and stored by Oil and Gas companies. Many of the innovative technologies require an internet connection for online troubleshooting, Software updates, back up, etc (Nechully et al., 2019a). But connecting these devices to the internet exposes the whole infrastructure to cyber-attacks – which can be very harmful to the whole plant. So, innovative technologies implemented should not compromise the security aspects of the plant (Nechully and Pokhriyal, 2019). Organizations prefer to adopt an innovation which adds an extra layer of security. A plant cannot afford to let somebody corrupt its database. Security features of the innovative technologies are also closely scrutinized by Oil and Gas (Nechully, Pokhriyal and Thomas, 2018b). So, organizations prefer innovative technologies with better security features.

10.3.57 MOTIVATED, COMPETENT AND QUALIFIED WORK FORCE

"Motivated, Competent, and Qualified workforce" is the greatest asset an organization can have. It is easy to train a competent and qualified workforce. Competent and dedicated employees are required to operate innovative technologies (Nechully et al., 2019c). Motivation level of the employees is very important. Competence alone will not do miracles; the employees should be motivated to learn new things. Only a motivated employee will be geared up to find innovation opportunities and to experiment with different technologies for those opportunities (Nechully, Pokhriyal and Thomas, 2018a).

10.3.58 INNOVATOR SUPPORT

The innovator can support during all stages of adoption (Nechully, Pokhriyal and Thomas, 2018b). The researcher has kept "Aftersales support" as a separate variable due to its importance. The researcher categorizes support of innovator till the finish of installation and commissioning into "Innovator support,'' and all the

other helps/supports after that into "After sales support." Innovator support is another variable which can make a significant contribution to the adoption of innovation (Nechully et al., 2019c). The innovator can provide valuable guidance throughout the adoption stages. The innovator can also provide support in terms of flexible payments terms, factory visits, etc.

10.3.59 COMPLIMENTARY INFRASTRUCTURE

Infrastructure is one of the important facilitating conditions for adoption. Technological infrastructure to adopt an innovation is crucial. Not only for adoption, but the relevant infrastructure is also required for utilization as well. An assessment of the infrastructure requirement also should be done before finalizing the innovation (Nechully et al., 2019a). Without necessary supporting infrastructure – the organizations should not even think of adoption, or they should have the confidence and capability to set up the necessary infrastructure before the implementation of innovation (Nechully, Pokhriyal and Thomas, 2018c). Without necessary infrastructure in place - the organization cannot implement and utilize innovation. Lack of infrastructure results in delays/non-adoption of innovation (Nechully et al., 2019c).

10.3.60 LEADERSHIP, MANAGEMENT SUPPORT, AND MANAGERIAL SKILLS

Leadership, Managerial Skills, and Commitment help an organization to overcome the barriers of adoption**.** Leadership and Managerial skills are required to comprehend the intricacies of adoption. Visionary leadership/management will always support new technologies – if they find it relevant to the organization (Nechully et al., 2019b). Without managerial skills and support – there will be chaos in the organization. Organizations require managerial skills to manage and mobilize the resources for Innovation adoption properly (Nechully and Pokhriyal, 2019). Visionary leadership is required to steer the organization through the downturn to its short term and long term goals. Strong leadership is required to

implement the innovation strategies and to coordinate various activities related to the adoption of innovation (Nechully, Pokhriyal and Thomas, 2018d). Management support is required to implement necessary changes in the organization in terms of infrastructure and competencies and to motivate employees to pursue innovation opportunities. Sufficient budgets are required to achieve these changes in organizations (Nechully et al., 2019d). Organizations require managerial skills to identify and select the correct people as leaders. Without management support and Commitment, adoption will not move an inch.

10.3.61 CENTRAL INNOVATION OFFICE

A Central innovation office can oversee the innovation activities in an organization. These centralized innovation offices should have innovation representatives in various branches to coordinate efforts. These innovation offices should be placed directly under the CEO or Management to bypass the normal hierarchies – if innovation is found relevant for an organization (Nechully and Pokhriyal, 2019). Other departments are pre-occupied with their day to day operations, and the existence of a central innovation office helps to coordinate all activities related to innovation. There are many activities these innovation offices can perform. It can promote a common platform for discussions regarding innovations – something like a website. It can also start a journal or magazine like "ADNOC Technical Review" for getting innovative ideas from the market. It can also encourage employees by announcing prizes for promising innovations**.** It can also dispel fear in the minds of employees to experiment with innovation by setting up a fund – that can be called "Let's Fail." A central innovation office can consolidate the innovation opportunities suggested by employees and test the practical feasibility of those opportunities (Nechully et al., 2019a). Central innovation office can evaluate the processes and technologies applied in an organization and suggest improvements (Nechully, Pokhriyal and Thomas, 2018d).

10.3.62 GENERAL MARKET CONDITIONS AND GOVERNMENT SUPPORT

General Economic Conditions facilitate changes – the way an industry operates. The general economic conditions changed the way ADNOC operated. They have streamlined all operations. Government support with favorable innovation policies helps to create a culture of innovation in the economy. General Economic Conditions affect General Business Confidence in an economy (Nechully and Pokhriyal, 2019). If the general scenario is not optimistic– a feeling of insecurity prevents all innovation activities in an organization. The unfavorable economic conditions have forced oil and gas companies to go on a cost-cutting drive. This cost-cutting drive may affect budgets as well for overall activities. Another contradictory view is that Oil and Gas will invest in innovative technologies to enhance the efficiency levels during the economic downturn (Nechully, Pokhriyal and Thomas, 2018a). Till 2014, companies sanctioned sufficient budgets for end-user requests. Procuring innovative technologies was not a big deal. When the scenario was rosy – with oil and gas companies making enormous profits, nobody cared about innovations. But post-2014, when the oil prices came down, Oil and Gas companies started scrimping on the budgets. The general procurement itself became a herculean task, which required many justifications on investments. When the scenario began changing – everybody started looking forward to costing savings and profitability (Nechully, Pokhriyal and Thomas, 2018c). When the market conditions were good, there was no shortage of funds for general procurement. But these were not spent on innovative technologies. There was a lack of direction in funds utilization. Government support in terms of funding innovative projects, various subsidies, etc. for innovation adoption help organizations (Nechully et al., 2019b).

10.3.63 ORGANIZATIONAL PRIORITIES AND STRATEGIES

Organizational Strategies for innovation adoption is very important. A strategy provides the organization clear cut directions for implementing the innovation and to coordinate between the various departments to implement change. Without a strategy – the implementation will be completely chaotic. The organization should anticipate the hurdles and should have a proper strategy in place to overcome those hurdles. Organizational strategies help to concentrate on strengths and to eliminate or reduce the intensity of weaknesses (Nechully et al., 2019b). Organizational Priorities also decide whether to adopt or not. Organizational Priorities can change the relevance of a particular innovation to the organization. Organizational priorities depend on Organizational objectives. External factors also influence Organizational priorities. It changes according to the objectives of the organization and external factors. As Organizational priorities changes, so do the Organizational Strategies. Organizational priorities also decide as to whether the technologies are to be developed in house or outsourced. Organization channelizes funds based on priorities assigned to different opportunities by the organization (Nechully et al., 2019d). When the market conditions were good – when the oil prices were high, the budgets were easily available; Priority was to discover more oil, not efficiency improvements. So, organizations give low priority to the adoption of innovations. Organizational Priorities change according to market conditions. The organizational priority in the economic downturn should be to enhance efficiency. Organizations evaluate innovations based on their ability to enhance efficiency levels - to enhance profitability (Nechully, Pokhriyal and Thomas, 2018d).

10.3.64 FIELD TRIALS

Oil and Gas processes are very critical. It cannot afford failures. So oil and gas always prefer proven technologies – at least it should be proven in fields trails. The results and performance during field trials enhance scientific credibility (Nechully et al., 2019d). Either it should be proven in the same field by field trials or in other fields. Successful field trials dispel “fear of failure.” Organizations will

not procure technologies if field trials cannot establish its scientific credibility (Nechully, Pokhriyal and Thomas, 2018a).

10.3.65 VENDOR REPUTATION

Reputation matters a lot for the adoption of innovation. Oil and Gas companies always prefer to deal with reputed vendors with necessary skill sets. This logic applies to innovation, as well. Reputation enhances the perception of the scientific credibility of an innovation (Nechully et al., 2019a). The end-users always expect reputed manufacturers to come up with something useful to them. End-users always trust an innovator with a record of successful innovations (Nechully, Pokhriyal and Thomas, 2018b).

10.3.66 PRODUCT FEATURES

The innovation also should have the features desired by the end-users. Features enhance scientific credibility. As the technologies evolve, there are certain features which the end-users expect from an innovator. If these features are not present, end-users question the scientific credibility of technologies (Nechully, Pokhriyal and Thomas, 2018b). End users get these expectations from other innovative technologies in the market – the best example is the touch screen from the mobile industry. Now all end-users expect innovative technologies to have a touch screen interface. Product features incite interest in the innovation (Nechully and Pokhriyal, 2019).

10.3.67 STATUTORY REGULATION AND INDUSTRY STANDARDS

Compliance with the industry standards is a mandatory requirement in Oil and Gas. The problem faced by most of the oil and gas companies and innovators alike is that – there are no “Pre-Set” standards in the oil and gas for emerging technologies, and this delays the adoption (Nechully, Pokhriyal and Thomas, 2018c). Organizations have to adhere to the statutory regulations made by the

government authorities, violation of which attract penalty depending on the gravity of the violation (Nechully et al., 2019c). Some of these standards are set by the third party or the industry or by the organizations itself.

10.3.68 GROUP PRESSURE AND IMAGE ENHANCEMENT

Group pressure forces compliance. Many times, the compliance is for image enhancement within the groups. The researcher redefines the variable "Group pressure" as "Group Pressure and Image Enhancement" as at times "Image enhancement" is required to maintain the membership in a particular group. So to belong to that group – the company has to comply with the Group requirement (Nechully and Pokhriyal, 2019). When the majority in the group is showing commitment towards a good cause, others in the group are forced to follow. When the whole industry is pursuing innovative technologies, there is pressure on Non adopting companies to change their attitude towards innovative technologies (Nechully, Pokhriyal and Thomas, 2018b). To be considered as a legitimate member of the group, the companies have to adopt innovative technologies (Nechully et al., 2019b). The Technologies are adopted just because somebody else in the group has adopted it. So the reputation is at stake in the group as well as in the industry

10.3.69 FIT TO WORK SETTINGS

Innovation should be able to meet the specific requirements of the organization. It should "Fit to the Work setting." The work settings in the plants will have specific applications or requirements which the innovation is supposed to fulfill (Nechully, Pokhriyal and Thomas, 2018d) - Emphasizes the need for innovative technologies should match the exact requirements of end-users or organizations. If it cannot satisfy the requirements, it will not be adopted or if it is adopted – it will not be utilized (Nechully, Pokhriyal and Thomas, 2018c).

10.3.70 LOCAL ADAPTABILITY

Adaptability to the local site/plant conditions is also important. The organization should have a clear cut idea as to "where and how to use." The technology selected should be suitable for the existing systems or the innovation should not require major infrastructure changes or additions or it should match with the proposed changes in the plant or organization (Nechully and Pokhriyal, 2019). Sometimes the technologies are not adopted because of their lack of adaptability to plant conditions. Customizing the existing system to the innovation can be a very costly, time-consuming, and risky affair (Nechully, Pokhriyal and Thomas, 2018a). For portable usage – Organization should not select a heavy instrument, which is difficult to carry to the field. Lack of local adaptability motivates end-users to change the innovation or delay the innovation adoption.

10.3.71 NORMS

Organizational Norms influence Organizational Customs in an organization. Norms guide the context-specific behaviors in an organization. Norms are the value systems, which defines the accepted practices within an organization or industry (Nechully, Pokhriyal and Thomas, 2018a). Norms represent the beliefs and values of an organization which decides what is wrong and what is right. Norms decide the acceptance levels of routines in an organization (Nechully et al., 2019c). As time passes by, the routines which get accepted becomes the customs of an organization. Changing norms helps organizations to change their customs. The norms of an organization have to change according to the changes in the business environment where it operates. Norms influence the customs of an organization.

10.3.72 ROUTINES

Routines are the recurring patterns of activities/behaviors within an organization – as a standard response to a problem. Routines are stable, predictable ways of doing things in an organization. Routines get repeated for executing the same or similar tasks in an organization. Routines are standard procedures or practices followed in an organization (Nechully, Pokhriyal and Thomas, 2018c). Routines become the customs of an organization when it gets widely accepted in the organization or industry (Nechully et al., 2019d). Customs are particular ways of doing a thing in an organization (practices or procedures), which is unwritten but which is accepted and followed by the majority of members in an organization for a long time. Sometimes the customs can become a hurdle in the way of innovation implementation. So the strategy should be to change the customs by changing the routines. Outdated customs are to be changed. Otherwise, it blocks the smooth adoption and implementation of innovations within an organization (Nechully and Pokhriyal, 2019).

10.3.73 JOB ROLES AND TENURE

The job roles should be very clearly defined. There should not be any overlapping responsibilities. A vague description of job roles creates frustration in the minds of employees. Organizations should give employees proper directions regarding the roles they have to perform so that they can utilize their skillsets properly. Organizations should convey about the performance expectations to the employees. Organizational climate is the aggregation of the employees feeling about their work settings (Nechully, Pokhriyal and Thomas, 2018a). A positive perception emerges if they have clearly defined job roles and authority to execute their tasks. Unstable job tenure creates a feeling of insecurity in the minds of employees. Employees prefer to have fixed term contract jobs. An employee with a long tenure with the organization can facilitate a smooth adoption of innovative technologies. Long tenure with an organization enhances the technical knowledge of the employees. A stable tenure enhances the commitment from the employees (Nechully, Pokhriyal and Thomas, 2018d).

10.3.74 AUTHORITY

Individuals should be adequately empowered to execute their tasks. If they do not have sufficient powers or authority to execute the assigned tasks, a feeling of frustration creeps in, and it makes them uncomfortable and induces a hostile feeling (Nechully et al., 2019c). If organizations do not give proper authority to the employees, then nobody takes responsibility, and the task of making a decision is passed on to others and ultimately gets delayed indefinitely (Nechully et al., 2019b). Empowerment in the lower levels reduces the burden on top-level executives. With sufficient authority, Superiors can enlist the support of non-cooperating employees.

10.3.75 WORKPLACE – REWARDS AND RELATIONSHIPS

Organizational climate refers to the perception of employees about their work environment. Organizational climate is affected by Rewards, Job Roles, Tenure, Authority, etc. Motivation from the upper management for good work in the form of rewards cultivates a good feeling about the work environment. Good work has to be acknowledged and rewarded. A workplace where good works are not appreciated creates a bad feeling in the minds of employees (Nechully et al., 2019a). Employees will not feel motivated to deliver their best if the exceptional works are not appreciated. Appreciation and rewards elicit commitments from employees. Relationships between coworkers inculcate a sense of mutual help in times of need. A good rapport with the colleagues facilitates work environment conducive for creativity to flourish. An individual always expects support and help from his colleagues. Fair reward systems and Good/Healthy relationships in the workplace cultivate a positive feeling about the workplace (Nechully, Pokhriyal and Thomas, 2018c).

10.3.76 ORGANIZATIONAL SIZE AND STRUCTURE

Bigger the company size, more difficult is to make decisions because of the various people/levels involved in decision making. Oil and gas companies are always big. Even a big company can make fast decisions if it has a flat structure or to speed up the adoption process – there can be alternatives to bypass these levels (Nechully, Pokhriyal and Thomas, 2018b). Organizations can enhance the speed of decisions by involving only the relevant levels, or another suggestion is to provide a channel to bypass the irrelevant levels to present the innovation to the decision making authorities (Nechully and Pokhriyal, 2019). The decision making is delayed by irrelevant levels who cannot comprehend the importance of innovation. Organizations need to reduce the levels in the organization. Most of the Oil and Gas organizations have a decentralized structure. Decentralization helps oil and gas to respond to external changes immediately (Nechully, Pokhriyal and Thomas, 2018a). Decentralized structure gives more opportunities and freedom for employees to self-develop. Decentralization creates better workplaces for employees. Decentralization gives authority to particular branches to take appropriate decisions (Nechully et al., 2019c). Decentralized nature of organization sometimes delays the decision making, especially when multiple departments are involved. Each unit functions as a separate entity, and the isolation affects the relationship between employees belonging to different departments. Departments/Individuals remain isolated in a decentralized structure. It affects knowledge transfer as well due to limited interactions. Flat organizations/De-Centralized organizations where the levels involved in decisions are smaller in number enhance the speed of decision making (Nechully, Pokhriyal and Thomas, 2018b).

10.3.77 END-USER INVOLVEMENT

End-user involvement helps to understand the “ground realities.” The end users are the “Infantry” of an organization, and they are the ones who will be ultimately using the innovation. Nobody knows the actual situation better than end-users. End-user involvement creates a sense of responsibility in them to use it and to

motivate others also to use it and reap the benefits of innovation (Nechully, Pokhriyal and Thomas, 2018a). End-user involvement creates a feeling of belongingness or a feeling of importance or a feeling of being considered – which enhances the commitment from them. End-user involvement enhances the chances of procuring the right product and services as they know firsthand the field conditions (Nechully et al., 2019d). Involving end-users can also cement a better relationship between the organization and the vendors. End-user involvement helps to "Quantify the Value of the product" for the company – which helps to evaluate the offers (Nechully, Pokhriyal and Thomas, 2018b). The involvement of end-users in decision making speeds up the implementation process –because of a sense of responsibility to successfully implement the decisions (for which they were also a part of)

10.3.78 COMMUNICATION CHANNELS

A communication channel should not compromise on the quality of information transmitted (message should not get distorted) and should be able to connect with the receiver to take live feedback. Channels of communication influence decision making. Channels of communication are of two types (1) Formal and (2) Informal. In a big typical organization in oil and gas – the communications are mainly through Formal channels (Nechully, Pokhriyal and Thomas, 2018a). There are well-established rules informal communications - Who and how to communicate? It helps to reach throughout the organization. In case of a problem – there is clarity regarding how it has to be reported and escalated. Formal channels delay the decisions as it has to follow a predefined route. Formal communication channels will have many irrelevant links, and the information gets filtered or at times, distorted (Nechully and Pokhriyal, 2019).

In big organizations, – informal communications can create chaos. Informal communication channels help to bypass irrelevant links and make speedy decisions. Informal channels of communications spread rumors in organizations

(Nechully et al., 2019b). There is no specified route for informal communications, and it propagates in all directions. Organizations do not use Informal channels for official communications. But informal channels can spread innovative ideas. Informal communications lead to a very relaxed work environment and better relationships in the organization (Nechully, Pokhriyal and Thomas, 2018d).

The channels of communication should be selected based on the message to be transmitted. Channel of communication plays a significant role in the communication between various hierarchies in the organization in the process of decision making. Emails are good for mass communication, but there is a tendency in the organizations to discard emails of General nature – not specific to the job. Presentation by the innovator is the best channel for communication regarding innovation (Nechully et al., 2019a). The presentation helps to clear doubts then and thereby interacting with the innovator. It helps to create a rapport with the innovator – which helps to proceed further. If physical presentations are not required – then WebEx presentations can be done (Nechully, Pokhriyal and Thomas, 2018d).

10.3.79 AGE

Young people come up with innovative ideas to prove themselves. Organizations can channelize the enthusiasm of youngsters to challenge the established ways of doing things for the betterment of the company. In Oil and Gas companies, there should be a mix of experienced and young employees (Nechully et al., 2019a). Young employees may bring in new ideas, but the feasibility of the ideas can be judged only by experienced employees, especially in oil and gas, where the criticality of operations is very high. The young people can generate fresh ideas, and experienced people can fine-tune these ideas for the applications in the oil and gas (Nechully and Pokhriyal, 2019). Moreover, the experienced employees can transfer the knowledge gained through their exposure and experience to youngsters.

10.4 CHAPTER CONCLUSION

The Researcher has categorized and consolidated the Insights / Information Observations under the respective headings of variables. The explanations, along with the framework proposed in the paper “FRAMEWORK ANALYSIS (STAGE 4): PROPOSING A VALIDATED FRAMEWORK TO ENHANCE THE ADOPTION OF INNOVATIVE DRILLING TECHNOLOGIES IN UPSTREAM OIL AND GAS” help Upstream Oil and Gas companies to make organization/department-specific strategies to enhance the adoption of innovative drilling technologies.

CHAPTER 11

STRATEGIES TO ENHANCE ADOPTION OF INNOVATIVE TECHNOLOGIES IN OIL AND GAS

11.1 INTRODUCTION

Oil and Gas has a conservative look towards Innovative technologies. Oil and Gas still rely on legacy technologies or processes in their plants. When the oil prices were above $100 per barrel, Oil and Gas companies were in a position, to afford all kinds of inefficiencies. They were making exorbitant profits. But now the scenario has completely changed.

At the time of drafting this report, the oil prices have stabilized around $70 per barrel. Oil and Gas being an Oligopolistic market, companies do not have any incentives within the industry to innovate. But alternative sources of energy are becoming very competitive, and very shortly, oil and gas will be facing stiff competition in the international market from these alternative sources. So it's high time for oil and gas to change, to gear up to meet the impending future challenges. The current scenario calls for oil and gas companies to have clear cut short and long term innovation adoption strategies.

11.2 THE FRAMEWORK USED AS REFERENCE TO DEVELOP STRATEGIES

The researcher uses the innovation adoption framework proposed by himself to formulate various adoption strategies – surprisingly, Innovation strategy itself happens to be one of the variables in the framework. Organizations need to formulate strategies to manipulate variables to progress from one stage of the innovation adoption to another – to accelerate the adoption process. Failure to

progress from one stage of adoption to another, delays adoption or leads to abandonment.

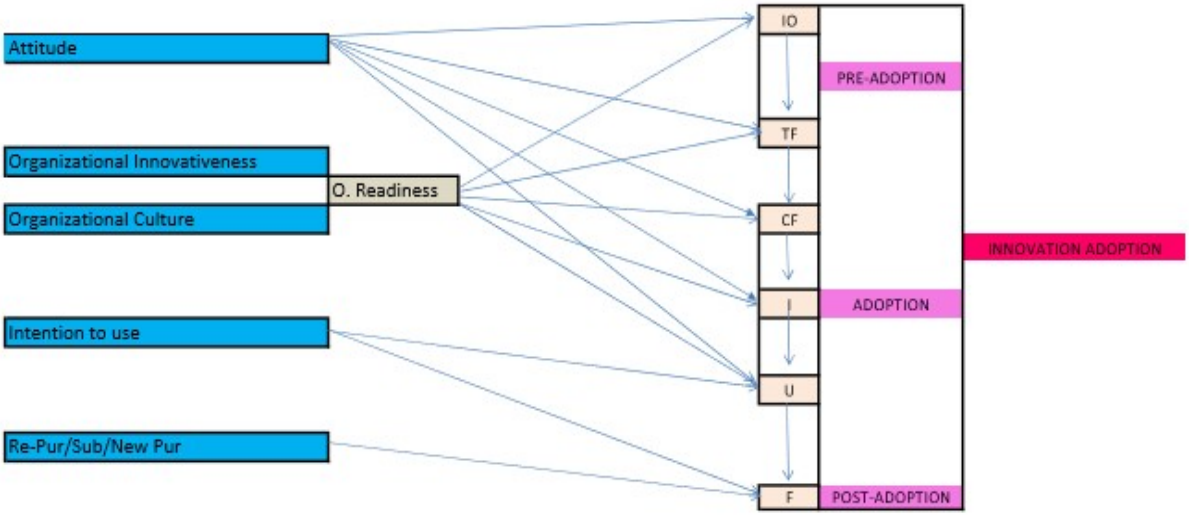

Figure 11. 1 Short Form of Proposed Frame Work

11.3 STRATEGIES TO ENHANCE INNOVATION ADOPTION IN OIL AND GAS

Organizational readiness impacts all stages of innovation adoption to utilization. Not only that, Organizational readiness boosts the confidence of the Organization and its employees to search for innovation opportunities. Without necessary resources, the innovation opportunity search will be a useless pursuit of wasting time, money, and effort – as the innovation cannot be implemented and utilized. To enhance organizational readiness, organizations should first cultivate a culture of innovation within the organization. It should also have an orientation toward innovation.

Changing the culture of an organization is not an easy task. Culture is the unique identity of an organization. The culture is deep-rooted in the organization. It takes time to change culture. The organization can change its culture can by changing the customs and climate of the organization. The employee's perception of the

workplace has to be changed. The employees will have a good feeling about the workplace if their job roles are well defined, and have a stable, secure job contract. The necessary authority should be given to execute their jobs. Employees should also have a feeling that somebody will be always listening and reward their efforts. Helping and Cooperating co-workers and healthy professional relationships create favorable feelings about the workplace. Organizations need to change workplace perception, and this change can be effected quickly compared to culture. Sometimes, the habitual deep-rooted practices which block innovations are also to be changed to foster a culture of innovation in the organization. Organizations can change the Customs by changing the routines – repeated patterns of behavior and acceptance level of these behaviors – Norms. Changing Norms and Routines changes the outdated customs of an organization.

Enhancing organizational innovativeness helps an organization to be prepared in advance for innovation adoptions. The learning capacity of an organization – to know more about innovative technologies enhances organizational innovativeness. As the absorptive capacity of an organization increases, its orientation towards innovation also increases. An organization cannot enhance it innovativeness without a visionary CEO and employees who would like to experiment with innovative technologies. CEO and Employee Innovativeness enhance the Absorptive capacity of the organization. Market structure and Competition also influence learning ability. The market structure decides the competition. In an oligopolistic market, there is no competition. But the Oil and Gas will have to face competition from the international energy market from alternative sources very shortly. This anticipation should enhance the absorptive capacity of organizations. A strong R&D to keep track of the latest trends and to act as an interface between academics and research enhances the absorptive capacity. Organizational openness to the business environment also influences the absorptive capacity. Only an open organization can feel the pulse of the market and change accordingly. The previous purchasing patterns lock

organizational orientations along certain lines of innovative technologies. Familiarity with Vendors also locks the purchasing patterns. The organizations should never get locked along certain lines of technologies or vendors. It should evaluate all innovations according to the merits rather than based on familiarity. Facilitating conditions enhances the ability and willingness to adopt innovations. Organizations should see to it that these facilitating conditions for innovation adoption exist. Infrastructure is one of the important facilitators without which organizations cannot adopt an innovative technology – organizations cannot implement and utilize it. Organizations should see to it that the complementary infrastructure is in place before the adoption process. Government support in terms of duty waivers, financial assistance, and various schemes can be availed by the organizations to speed up the adoption process. Especially when the oil and gas are experiencing the downturn, organizations have to avail all government supports available. Organizations can enlist the support of innovators – who are hungry for business, throughout the adoption stages. The innovator can give necessary directions for the smooth adoption of innovation. In this framework – the support from the innovator is divided into two (1) Innovator support: Till Installation and Commissioning (2) After Sales Support: Post Installation and Commissioning. Organizations need to ensure that the innovator will provide all necessary support, and Organizations can include aftersales support as a separate clause in the contract itself. Leadership, Managerial Skills, and Management support are facilitating conditions for a smooth adoption. Leadership skills are required to oversee the innovation adoption – somebody should be there to lead from the front. Managerial skills are required to analyze the intricacies of innovation adoption. Management support boosts the confidence of employees to search for innovation opportunities. Organizations should see to it that it has leaders to provide the necessary directions, managerial skills to guide the adoption process, and supportive management to release budgets at the right time. Organizations should also ensure that the employees recruited are qualified enough to learn new technologies, motivated to find innovation opportunities, and

competent enough to operate innovative technologies. A perfect alignment of Priorities, Innovative technologies, and strategies accelerate adoption. Most of the departments and employees will be preoccupied with their day to day works. A Central Innovation Office to take care of all innovation activities speeds up the adoption process. The Central Innovation Office can scan the market for innovations and test its application feasibility. If proved relevant – the central office should be empowered to present the proposal directly to management for approval – bypassing the usual approval hierarchies. A common platform like a website or a Technical Journal from Central Innovation office facilitates the discussions regarding sector-specific innovations. Relevant, timely, and trustworthy information enhances organizational innovativeness. There are many ways for organizations to acquire information – through partnerships, social media, referrals, Journals, exhibitions, Seminars, etc. Organizations should encourage their employees to visits exhibitions and take part in seminars/workshops etc. conducted by the innovators.

Intention to use as a variable influences utilization and future technology usage decisions — hype cycles influences usage intentions in organizations. Hype cycles lead to an exaggeration of benefits, and the end-users will be very eager to utilize the innovation. But the innovation might not deliver the results as expected by the end-users. Organizations should not fall for hype cycles. They should evaluate the innovation before adoption. Organizations should evaluate Industry trends and Optimism before making adoption decisions.

Decision styles can be top-down or bottom-up approaches. A top-down approach is an autocratic style where the top-level executives make decisions and pas down to the lower levels. The actuals end users cannot contribute to these decisions. A Bottom-up approach is an approach where all relevant persons are involved in decision making. Organizations give due importance to the suggestion from the lower levels. It might not always be possible for an organization to take a bottom-up approach while making decisions. But for Innovation adoption decisions, the

organizations should follow a bottom-up approach to factor in the ground realities from the end-users. A Bottom-up approach enhances the commitment from the employees to utilize innovations for the benefits of the company. Oil and Gas companies are always big. Decision making in big companies is very time-consuming. At least for some of the oil and gas firms, the size can be reduced by reducing the redundant designations and unwanted levels. A flat, decentralized structure helps to respond to the changes in the business scenarios by reducing the time drastically.

Organizations need to review their size and structure to speed up the decision making the process.

Organizations should have both formal and informal communication channels. In a formal channel, the flow is predefined – How to convey a message from one department to another? Even though a bit time consuming, it will not lead to loose talks in organizations. Informal channels of communication improve the relationships within the organizations, solve problems more efficiently, transmit messages quickly, and enhances openness and flexibility. An organization should promote both formal and informal channels of communication for innovation adoption. Organizations should promote a mixture of young and experienced employees. The experienced employees can fine-tune the innovative ideas proposed by the young employees for precise applications in the plant. Organizations should see to it that innovation meets the necessary industry standards and statutory requirements. Any changes in standards or legal requirements change usage intentions. Non-compliance with industry standards and statutory requirements either delays the adoption or results in premature abandonment. Organizations should also see to it that the proposed innovation exactly meets the field requirements and should be compatible with the existing systems and procedures. Lack of customization and compatibility delays the utilization of innovation. Organizations should select innovations from innovators capable of providing excellent after-sales services and 24 x 7 technical support.

All organizations have a latent tendency to continue with the existing technologies due to satisfactory results delivered by them. There are always risks/uncertainties associated with innovative technologies. Oil and Gas cannot afford failures as millions are involved in innovation decisions. Another reason for resistance to change is the lack of self-confidence to master the usage of innovation. The organizations can conduct training programs to enhance the competency levels and confidence of employees. The employees should be convinced about the benefits of innovation – to utilize innovation by coming out of their comfort zones. Organizations can reduce Risk/Uncertainties by setting asides funds as contingency funds to experiment with innovations without the fear of failures.

User Satisfaction and Trust also influence the intention to use. User Satisfaction has two dimensions (1) User satisfaction and trust derived during actual usage (2) User satisfaction and Trust derived from other innovations from the same innovator/brand. The satisfaction derived from the usage of innovations from the same innovator builds, trust on that innovator. This trust reduces or helps to eliminate the initial reluctance on the part of the end-user to use a particular innovation. The satisfaction and Trust from the earlier product usages contribute to building a favorable environment for innovation adoption. While using the innovation in the plant, it has to deliver the expected results. Using the innovation should be a pleasurable experience to the end-user. So an organization should select an innovator who has a history of successful innovations, which has given and is capable of giving satisfaction and pleasurable experience to the end-users.

Continued Usage and Repurchase/Substitution/New Purchase affects the future technology usage decisions in Oil and Gas. Technological advances create incremental or disruptive innovative alternatives. Incremental innovations create Inter-Generational Competitions. Technological advances lead to Substitution of the existing system with incremental or disruptive innovations. Re-Invention of the product – for new usages – either from the innovator end or end-user end

prolongs the usage and leads to continued usage and Re-purchase. At times, there might not be a better alternative available in the market, and the end-user will be happy with the performance of the innovation – which also results in Continued usage or Re-Purchase to other locations in the same company. At times the innovations are so disruptive that existing procedures or even the innovation opportunity itself becomes irrelevant. During such a scenario – the Oil and Gas go for a New Purchase for an entirely new innovation opportunity. Brand loyalty forces oil and gas companies to buy only from one innovator or a specific set of innovators. Trade up or Buyback schemes speeds up the Re-Purchase or Substitution. The oil and gas companies need to compare and evaluate the technologies coming to the market – whether to continue or to do re-purchase/substitute or entirely new purchase. Trade up, or Buyback clause can be inserted in the contract – for incremental or disruptive innovation from the same innovator – For a certain percentage of the base price. Oil and Gas companies should never get into the trap of Brand loyalty and limit their options.

Favorable attitude towards innovation speeds up the adoption process. Attitude influences all stages of adoption till utilization. A favorable organizational attitude towards new technologies and procedures motivates employees also to take part in all innovation-related activities. Oil and Gas companies always have a favorable attitude toward Proven Technologies. Oil and Gas companies need to evaluate the scientific credibility, either by the results during field trails or from the usage of technologies in other industries. The reputation of the vendor for successful innovation and the product features also should be taken in to account during evaluation. Generally, without some minimum features, the product is not accepted in the industry. Minimum Efforts and Maximum Results cultivate a favorable attitude towards innovation. The Oil and Gas companies need to select innovations (if available), which are easy to learn and use. End users show reluctance to use technologies that are difficult to operate. Oil and Gas companies should not waste time and effort pursuing technologies for which the management will not allocate budgets.

Affordability creates a favorable attitude towards innovation. Sufficient budget availability to cover the market price and switching cost creates a favorable attitude to pursue innovation further. Usefulness and Benefits derived from innovation creates a favorable attitude towards innovation. Oil and Gas companies should select innovative technologies which reduce the footprint and duration of the processes/operations, enhances the safety of personnel and security of the systems and ultimately delivers cost-saving and profitability. Perceived Usefulness has got two dimensions from a practical point of view. From a theoretical perspective, anything useful to the organization should be useful to the employees as well. From a practical point of view, this is not the case always. All employees are not 100% committed to the organization. They are interested in innovation if the innovation enhances their Job performance. Hence, the Oil and Gas companies need to convince the end-users or employees as to how innovation enhances their job performance.

Organizations should take care of region-specific variables. For example, in UAE Oil and Gas - ICV Score, Local Presence and Country of Origin influences attitude towards innovative technologies. ICV score reflects the Value contributed to the UAE economy by the vendors. A High ICV attract favorable attitude from the procurement department. In various tenders/RFQs, ADNOC gives vendor with the highest ICV to match the lowest price quoted. So Oil and Gas companies should encourage prospective innovators to have a high ICV score for getting consideration in the Local and International tenders. A local presence elicits favorable attitude from procurement and end-users. A local presence in Abu Dhabi is required to apply for special passes for access to oil and gas plants. Oil and Gas companies should encourage innovators to establish a local presence in Abu Dhabi. End-users always prefer products/technologies from US/UK/European Innovators. Of lately, this has been changing. But Oil and Gas companies should encourage its employees to keep an open mindset to evaluate technologies irrespective of Country of Origin. There are many technologies or

products available from Non-US/UK European innovators whose quality is at par with any US/UK European innovator but a lower price.

11.4 CATEGORIZATION OF VARIABLES INTO ENABLERS AND BARRIERS

A categorization of variables to "Enablers" and "Barriers" helps to formulate strategies. An Enabler accelerates innovation adoption, and Barrier retards innovation adoption. In this framework, organizations should enhance the enablers, and reduce the intensity of barriers or completely remove the barriers to speed up the innovation adoption in Oil and Gas.

Table 11.1 Categorization of Variables

No	Enablers	Sub - Stage	Stage	Barriers	Sub-Stage	Stage
1	Organizational Readiness	IO, TF, CF, I, U	PA, A	Organizational Culture	IO, TF, CF, I, U	PA, A
2	Organizational Innovativeness	IO, TF, CF, I, U	PA, A	Organizational Attitude	IO, TF, CF, I, U	PA, A
3	Intention to use	U, F	A, PT	Re-Purchase or Substitution or New Purchase	F	PT
4	Usefulness and Benefits	IO, TF, CF, I, U	PA, A	Effort	IO, TF, CF, I, U	PA, A
5	Affordability	IO,	PA,	Purchasing	IO,	PA,

		TF, CF, I, U	A	Patterns	TF, CF, I, U	A
6	Scientific Credibility	IO, TF, CF, I, U	PA, A	Decision Styles	U, F	A, PT
7	Absorptive capacity	IO, TF, CF, I, U	PA, A	Resistance to change	U, F	A, PT
8	Facilitating Conditions	IO, TF, CF, I, U	PA, A	Organizational Climate	IO, TF, CF, I, U	PA, A
9	Information	IO, TF, CF, I, U	PA, A	Organizational custom	IO, TF, CF, I, U	PA, A
10	Hype Cycles	U, F	A, PT	Risk/Uncertainty	U, F	A, PT
11	Compliances	U, F	A, PT	Satisfaction with Old Technologies	U, F	A, PT
12	Customization and Compatibility	U, F	A, PT	History of Purchases	IO, TF, CF, I, U	PA, A
13	User Satisfaction and Trust	U, F	A, PT	Familiarity	IO, TF,	PA, A

					CF, I, U	
14	Aftersales Support	U, F	A, PT	Complexity	IO, TF, CF, I, U	PA, A
15	Industry Trends	U, F	A, PT	Market Structure and Competition	IO, TF, CF, I, U	PA, A
16	Optimism	U, F	A, PT	Price	IO, TF, CF, I, U	PA, A
17	Self-Efficacy	U, F	A, PT	Switching Cost	IO, TF, CF, I, U	PA, A
18	After Sales Service	U, F	A, PT	Time budgets	IO, TF, CF, I, U	PA, A
19	Tech Support	U, F	A, PT	General Market Conditions.	IO, TF, CF, I, U	PA, A
20	Ease of use	IO, TF, CF, I, U	PA, A	Priorities and Strategy	IO, TF, CF, I, U	PA, A

21	Ease to learn	IO, TF, CF, I, U	PA, A	Brand Loyalty	F	PT
22	Beliefs and Outcome	U, F	A, PT	Re-Invention	F	PT
23	User Experiences	U, F	A, PT	Organizational Norms	IO, TF, CF, I, U	PA, A
24	Production Timeliness	U, F	A, PT	Organizational Routines	IO, TF, CF, I, U	PA, A
25	CEO and Employee Innovativeness	IO, TF, CF, I, U	PA, A	Organizational Size and Structure	U, F	A, PT
26	R&D	IO, TF, CF, I, U	PA, A	Age	U, F	A, PT
27	Organizational Openness	IO, TF, CF, I, U	PA, A	Communication Channels	U, F	A, PT
28	Budgets	IO, TF, CF, I, U	PA, A	Local Presence	IO, TF, CF, I, U	PA, A

29	Cost Saving & Profitability	IO, TF, CF, I, U	PA, A	Country of Origin	IO, TF, CF, I, U	PA, A
30	Environmental Benefits	IO, TF, CF, I, U	PA, A			
31	Security	IO, TF, CF, I, U	PA, A			
32	Safety	IO, TF, CF, I, U	PA, A			
33	Infrastructure	IO, TF, CF, I, U	PA, A			
34	Central Innovation Office	IO, TF, CF, I, U	PA, A			
35	Innovator Support	IO, TF, CF, I, U	PA, A			
36	Leadership and Support	IO, TF,	PA, A			

		CF, I, U				
37	Skilled Work Force	IO, TF, CF, I, U	PA, A			
38	Trade up or Buyback	F	PT			
39	Technology Advances & Alternatives	F	PT			
40	Field Trial Results	IO, TF, CF, I, U	PA, A			
41	Product Features	IO, TF, CF, I, U	PA, A			
42	Vendor Reputation	IO, TF, CF, I, U	PA, A			
43	Group Pressure	U, F	A, PT			
44	Standards	U, F	A, PT			
45	Fit to Work Settings	U, F	A, PT			
46	Local Adaptations	U, F	A, PT			
47	Job Roles and Tenure	IO,	PA,			

		TF, CF, I, U	A			
48	Authority	IO, TF, CF, I, U	PA, A			
49	Relationship and Rewards	IO, TF, CF, I, U	PA, A			
50	End-User Involvement	U, F	A, PT			
51	Enhanced Job Performance	IO, TF, CF, I, U	PA, A			
52	ICV	IO, TF, CF, I, U	PA, A			

11.5 CHAPTER CONCLUSION

Innovative technologies can play an important role in oil and gas, especially in this downturn to reduce cost and enhance profitability. But compared to other sectors or industries, oil and gas lags in Innovation adoption. The Researcher has identified the innovation adoption stages and variables relevant to these stages. The Researcher has also proposed various strategies to enhance the innovation adoption.

The researcher has confined this study to UAE Upstream Oil and Gas. But the intensity or presence of variables affecting the adoption of innovative technologies in the Oil and Gas sector differs from one organization/country/region to another. So Oil and Gas requires Organization/Country/Region-specific Innovation Adoption strategies to remain competitive as a source of energy in the years to come.

CHAPTER 12

PRACTICAL IMPLICATIONS OF STUDY

12.1 IMPLICATIONS

The international energy market will become very competitive in the years to come. Alternative energy resources becoming very competitive, affordable and accessible, probability of finding new reserves very low and low oil prices in the international market – all these reasons call for oil and gas to do away with their conservative outlook. Oil and Gas companies need to adopt innovative technologies to lower the cost and enhance the volume of production from their existing fields. Oil and Gas companies need to streamline the operations, lower cost, increase efficiency, and enhance the profitability of operations. To put it in simple words – Oil and Gas companies need to change.

Oil and Gas need to be aware of the technological advancements in the international scenario and frequently/constantly evaluate the technologies being deployed by them. If oil and gas companies find a technology promising or better compared to their existing ones, they should adopt it or at least initiate the process. The work done by the researcher – the proposed Framework helps organizations to make an introspection – to identify the presence of enablers and barriers of innovation adoption. Organizations can evaluate its "Current State of Affairs." The adoption of innovations is a cyclic process. The proposed framework helps organizations to evaluate at what stage of adoption a particular technology is and to manipulate the relevant variables for the transition to the subsequent stages.

Organizations can create a template of variables (to check the presence/absence) and assign "marks" to evaluate the intensity of variables. Organizations can also assign weights to these variables (based on the relevance of the variables in

adoption decisions) and arrive at a “minimum cut off score” to evaluate the “overall organizational readiness.”

Table 12. 1 Total Weighted Score Template

S No	VARIABLES	INTENSITY (I)	WEIGHTAGE (W)	SCORE = W X I
1	A			
2	B			
3	C			
4	D			
5	E			

Table 12. 2 Cutoff Criteria

S NO	OVERALL READINESS SCORE = ∑ W X I	REMARKS
1	∑ W X I > MINIMUM READINESS CUT OFF	IDEAL FOR ADOPTION
2	∑ W X I = MINIMUM READINESS CUT OFF	OK FOR ADOPTION
3	∑ W X I < MINIMUM READINESS CUT OFF	NEED TO WORK ON

Organizations can perform a “Gap Analysis” and formulate strategies to close the gap. Each Innovation is unique in terms of “specific requirements” for adoption and utilization. Organizations can formulate Variables/Technology, specific strategies. Organizations can pinpoint the Departments/Personnel responsible for variables or closing gaps and accordingly assign necessary tasks.

Table 12. 3 Gap Analysis

VARIABLE	CURRENT STATE	DESIRED STATE	STRATEGIES – TO CLOSE GAP	DEPARTMENT / EMPLOYEES
A				
B				
C				
D				
E				

Organizations can align the Innovation Requirements with the Resource requirements, Strategies, and Future objectives/Goals of the organization. To make a long story short – The Framework helps Oil and Gas companies to analyze – "The current state" and "Ideal Future state" for enhancing adoptions and formulate strategies for this transition.

Table 12. 4 Aligning Objectives Vs. Opportunities Vs. Technologies Vs. Resources

PRIORITY LEVEL	OBJECTIVES / GOALS	INNOVATIO-N OPPORTUNITY	JUSTIFICATION	INNOVATIVE TECHNOLOGIES SELECTED	ORGANIZATIONAL REQUIREMENTS	BUDGETS

Innovation marketers can identify the relevant variables affecting the different stages of adoption and formulate strategies to enhance the diffusion of innovation. Examples: Aftersales Support is found to be a relevant variable affecting

adoption. So when the innovator approaches the target market – they can highlight their capability to provide after-sales support. Scientific Credibility is another variable. The excellent results obtained in other segments or industries can be highlighted to elicit a favorable attitude towards innovator and innovation.

Organizations/Scholars can study adoption from two perspectives – "Marketer Perspective" and "End User Perspective." When the organizations/scholars do it from the "End-user Perspective," it is called "Adoption" and from "Marketer Perspective," it is called "Diffusion." "Adoption of Innovation" is the process by which a particular system adopts something "New." Rogers (1983) defines Diffusion of Innovation as "how an innovation spread within a group, community or country." It describes "how the process of adoption went – Classical S Curve or a different curve." Adoption occurs at the individual levels. Individuals can only adopt. Diffusion occurs at the Market level. In short, diffusion is the process of innovation adoption by the Target market. Adoption is the process of procurement and utilization of innovation by the individual members of the target market. Variables will be more or less the same for both – but the "Strategy Perspectives" will be different for Marketers and End Users.

12.2 CHAPTER CONCLUSION

Any research work, however, theoretically sound it is, is a complete waste of time and effort if the researcher cannot explain the significance of the results to the industry. The Researcher needs to communicate very clearly – without any element of ambiguity as to how the researcher can apply the results in the industry – "Industry-specific relevance" of the study should be highlighted – to call research – a meaningful work. In this chapter, the researcher has explained, how the proposed Framework can be used (1) to arrive at "minimum cutoff score" to evaluate the organizational readiness (2) to Perform Gap Analysis and formulate strategies to close the gap (3) for Task/Role assignments (4) by Innovation Marketer in formulating strategies.

CHAPTER 13

CONTRIBUTION TO THEORY AND INDUSTRY, LIMITATIONS AND FUTURE SCOPE OF STUDY

13.1 CONTRIBUTION TO THEORY

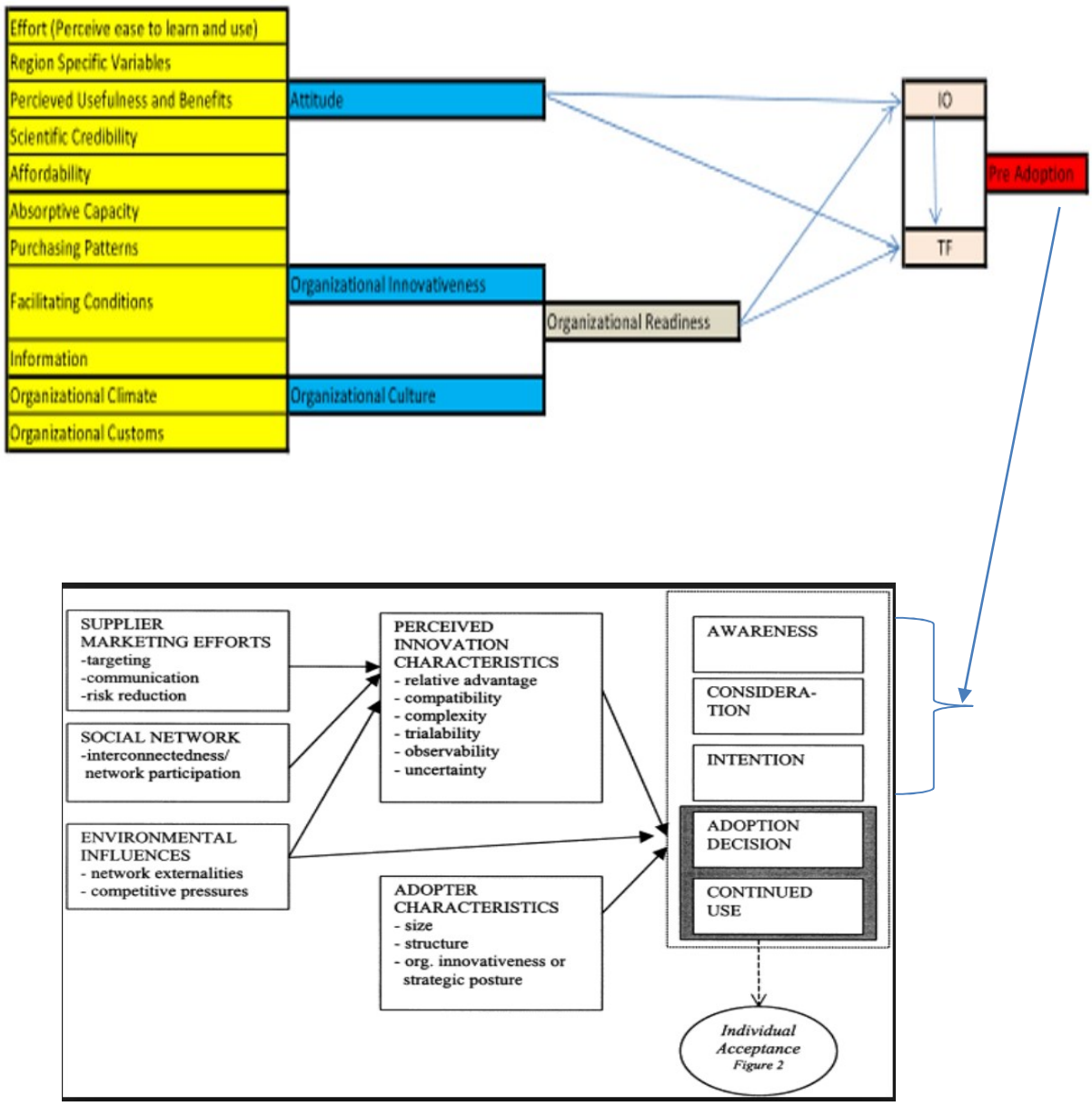

Figure 13. 1 Base Model: Frambach & Schilleweart Model - Enriched by Pre-Adoption Variables

13.1.1 THE INFLUENCE OF PRE-ADOPTION VARIABLES

The Study proposes "Pre-Adoption Variables" – which can be manipulated to facilitate the transition from "Pre-Adoption" to "Adoption." Pre-Adoption variables help to create an environment conducive for innovation adoption. The study identifies "Attitude" and "Organizational Readiness" as the main Pre-Adoption variables. An organization needs to incite a favorable attitude towards innovation opportunities/improvement opportunities in the minds of employees. The organization also needs to convey the "state of preparedness" to all concerned departments/employees. Only then will the employees/departments search for innovation/improvement opportunities within and outside the organization and select innovative technologies suitable for betterment opportunities.

13.1.2 THE INFLUENCE OF REGION SPECIFIC VARIABLES

Another important contribution is the influence of "Region Specific Variables," namely In-Country Value (ICV), Local Presence and Country of Origin – on the process of adoption through the main variable "Attitude." To create a positive attitude towards the innovative technologies, the organization should encourage innovators to have high ICV score and establish Local presence. The organization has to do away with the perception of "Poor Quality" for Non-US/UK/European brands, and the organizations should evaluate innovations based on its merits.

13.2 COMPARING AND CONTRASTING THE PROPOSED FRAMEWORK

Diffusion studies started in the field of Anthropology in the Late 1800s. Diffusion scholars were initially interested only on how cultural traits transmitted from one place to another or how it spreads among groups. There were contradictory views. Diffusion scholars like Mason (1895), Boas (1889), Ratzel (1882), Frobenius

(1898), Schmidt (1906), Graebner (1911) and Clark (1923) posit that the similarities in cultural traits are due to geographical proximity and frequent interactions. Another view proposed by scholars like Smith (1933) and Perry (1935) was that Egypt was the cradle of civilization, and all traits originated from Egypt and spread to other parts of the world. During the period of the 1880s to 1920s – No attempts were made to study the process of diffusion or variables affecting the diffusion process.

During the 30s till the early 50s, there were attempts by scholars like Gaudet (1930), Lazarsfeld (1944), Lasswell (1948) and Gerbner (1956) to study the process of communication - how can the messages be communicated without distortions between the sender and receiver and how can the feedback be elicited. The process of communication forms the basis of "Process Stream of Research." There were some attempts in 40/50s – "Lowa Corn Experiments" to study the process of diffusion of hybrid corn seeds in the State of Lowa and the researchers like Ryan and Gross (1949), and Girliches (1957) came up with the reasons for slow adoption. Here also the scholars did not integrate the "Process Stream" and "Factor Stream" of research.

It was in 1962 that Rogers came up with a systematic study of Diffusion – widely known as "Diffusion of Innovation." Roger mapped the process of adoption systematically - (1) Knowledge (2) Persuasion (3) Decision (4) Implementation (5) Confirmation and proposed that six variables namely (1) Relative advantage (2) Visibility (3) Trialability (4) Re-Invention (5) Visibility (6) Complexity influenced the adoption decisions. One of the main disadvantages of this model was that it did not explain the variables affecting the Pre-Adoption stage.

Rogers also divided the entire market into (1) Innovators (2) Early adopters (3) Early majority (4) Late majority (5) Laggards. There were many attempts by other diffusion scholars also to classify the market into various adopter sets. Bass (1969) divided the market into (1) Innovators and (2) Imitators. Sharif and Ramanathan (1981) categorized the market into (1) Rejecters (2) Adopters (3)

disapprovers (4) Uncommitted. But all these studies helped to enhance the knowledge from a "Marketer Perspective." These studies helped Innovators to penetrate the market. They need to target first the "Innovators" and from there slowly and steadily branch out to others in the market.

Till the late 70s – many of the Diffusion/Adoption studies were concentrated on the process of adoption. The 80s witnessed the emergence of "Factor Stream" of research.

The integration of Factor Stream and Process Stream of research became common with the Technology Adoption studies done by scholars like Scherer (1986), David (1990), Hays (1996), and Ellison and Drew (1991). Full-fledged research on Technology adoption models and theories started with the Study of Davis, Bagozzi, and Warshaw on Information Systems adoption – Technology Acceptance Model in 1989. Technology acceptance models proposed by scholars like Tornatzky and Fleischer (1990), Kaun and Chau (2001), Taylor and Todd (1995) and Helper (1995) primarily dealt with the acceptance of innovative technologies – during those times – computers by the employees of an organization. The scholars mentioned above focused along the "Employee Perspective" of utilization only. The organization first adopts the technology, then implements it and encourages employees to utilize it. But Adoption and Implementation dimensions were neglected.

Moreover, TAM models concentrated only on three main variables – (1) Intention to use (2) Perceived Usefulness (3) Perceived ease of use. Later versions of TAM proposed by scholars like Wang and Liu (2010), Parmentola, Simoni and Tutore (2018), Keller and Suzuki (2014) and Mckeown and Barnett (2012) added variables like Price, Norms, Beliefs, etc. Still, it was inadequate to get a holistic perspective on adoption as the scholars have overlooked the Organizational Pre-Adoption, Adoption and Implementation, and Post Adoption phases. Innovation Adoption is a cyclic process. The organization always should be on the lookout for innovative technologies. If something better comes in the market, it has to

explore the feasibility of adoption - Needs to evaluate whether to replace the existing technologies.

A study of adoption is incomplete without mapping all three phases on adoptions: (1) Pre-Adoption (2) Adoption (3) Post-adoption and identifying relevant variables affecting all three phases. Moreover, scholars should undertake study from both (1) Organizational and (2) Individualistic Perspectives. Very few models, like Frambach and Schilleweart (2002) has combined these two perspectives. Innovation adoption is beneficial to an organization if and only if the employees put these innovations in their day to day applications. That means innovation has to be adopted by the organization, and it has to be utilized by the employees. Many of the organizational adoption models deal only with the implementation of adoption – which only is a "sub-stage" of adoption.

Moreover, the studies should also concentrate on region-specific variables. Each country/Industry will have some specific variables significantly impacting the process of adoption. These variables also should be incorporated into the study.

So, to get a holistic perspective on adoption – (1) Factor stream has to be integrated to Process Stream of research. Organizations should identify the Variables and their influence on all stages of adoption. (2) Organizational and Individualist Perspectives to be combined. (3) Region-specific variables also should be incorporated into the study. The Framework proposed by the researcher explains variables affecting all stages of adoption with special emphasis to Pre-adoption variables – which are overlooked by other studies. It also combines Organizational and Individualistic Perspectives – Organizational Pre-Adoption, Organizational Adoption – covering adoption by organization and utilization by individuals, Post-adoption by Organizations. The Researcher proposes the Pre-adoption variables, namely (1) Attitude and (2) Organizational Readiness to the adoption literature. The Researcher also studies the impact of region-specific variables, (1) ICV Score (2) Country of Origin (3) Local presence. The Researcher divides the Stages of adoption into Innovation Opportunity Search and

Technology Finalization for Pre-Adoption, Contract Finalization, Implementation and Utilization for Adoption stage and Future Technology Usage for Post - Adoption. The Researcher explains the variables affecting each of these stages and organizations need to manipulate these variables to facilitate the transition from one stage to other

The Main Differences with the existing frameworks are (1) Pre-Adoption Variables defined (2) Impact of Region Specific Variables also studied – ICV Score, Local Presence, and Country of Origin.

13.3 CONTRIBUTION TO THE INDUSTRY

1. The framework will act as a source of reference to enhance the adoption of innovative technologies for companies in UAE Oil & Gas thereby enhancing the bottom line
2. It will be also beneficial to innovation marketers to identify the relevant adoption variables and to formulate suitable marketing strategies to penetrate the UAE Oil & Gas industry.

13.4 LIMITATIONS OF THE STUDY

1. The study is carried out in the Upstream UAE Oil & Gas sector only. The framework developed can be tested in other segments and geographical areas.
2. The researcher conducted the study from an end-user perspective only. Diffusion scholars can also do the study from Marketer's perspective.
3. The studies are confined to "Breakthrough Innovations" only. The Researcher has discarded other forms of innovation, like Incremental innovations.
4. The study is confined to Innovation in breakthrough technologies only – innovations in Management Practices, Processes, Services, or Internal Innovations – are left out for further research.

5. Categorization of Oil & Gas companies into various Adopter categories and classification of factors specific to each adopter set is left out for further research, which itself is a vast area of research.

13.5 FUTURE RESEARCH

1. Researchers can test the model in different geographical regions, Industries, or for other processes, management practices, or services.
2. A study can also be conducted from a marketer point of view to enhance the "Diffusion of Innovation" in UAE Oil & Gas sector.
3. Researchers can make an effort to categorize the ADNOC group of companies into different adopter sets and propose variables specific to each category
4. Researchers can also undertake studies on other forms of innovation, like incremental innovations.

13.6 CHAPTER CONCLUSION

The Researcher bridges the Theoretical Gap by proposing the Relevant Pre-Adoption Variables. The Researcher has explained the roles of main Pre-Adoption Variables: (1) Attitude and (2) Organizational Readiness in detail. The Researcher has also studied the influence of Region Specific Variables through the main variable Attitude on the adoption process. The proposed framework is compared and contrasted with the existing theories and models of adoption. Organizational and Individual dimensions are combined to get a better understanding of the adoption process. The Researcher has divided the Adoption process into – Innovation Opportunity Search, Technology Finalization, Contract Finalization, Implementation, Utilization, and Future usage. No work is 100% perfect. The researcher has communicated the limitations of the work to the readers. The researcher has also added the directions along which further studies can be undertaken to enrich the innovation adoption literature.

CHAPTER 14

REFERENCES

1. Abrahamson, E., 1991. Managerial Fads and Fashions: The Diffusion and Rejection of Innovation. *The Academy of Management Review,* 16(3), pp. 586-612.

2. Accenture Consulting, 2016. *The 2016 Oil and Gas Digital Trends Survey*. [Online] Available at: <https://www.accenture.com/ae-en/insight-2016-upstream-oil-gas-digital-trends-survey> [Accessed 07 November 2016]

3. ADNOC, 2019. *One of the Largest Energy Producers.* [Online] Available at: < https://www.adnoc.ae/> [Accessed 05 March 2019]

4. Ahmed, A., 2015. *From Oil to Knowledge – Transforming the United Arab Emirates into a Knowledge-Based Economy Towards UAE Vision 2021.* [LinkedIn]. 28 November. Available at: < https://www.linkedin.com/pulse/from-oil-knowledge-transforming-united-arab-emirates-economy-ahmed> [Accessed 21 September 2017]

5. Ajzen, I., 1991. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes,* 50, pp. 179-211.

6. Amara, R.C., 1983. *Business Planning for an Uncertain Future*. New York: Pergamon Press.

7. Anderson, N. H., 1971. Integration Theory and Attitudinal change. Psychological Review, 78(3), pp. 171-206.

8. Aquiar, A.S. and Reis, A.P., 2008. Why do firms adopt e-procurement systems? *IEEE Transaction in Engineering Management*, 55(1), pp. 120-133.

9. Armenakis, A.A. and Berneth, J.B., Pitts, J.P. and Walker, H.J., 2007. Organizational change recipients scale. Development of an assessment instrument. *Journal of Applied Behavioral Science*, 43(4), pp. 481-505.

10. Arnholt, M.W. and Batte, M.T., 2003. Precison farming adoption and use in ohio: Case studies of six leading adopters. *Computers and Electronics in Agriculture*, 38(2), pp. 125-139.

11. Arrow, K., 1962. Economic Welfare and the Allocation of Resources to Invention. In: *The rate and direction of inventive activity: Economic and Social Factor*. Princeton: Princeton University Press.

12. Aviles, M., 2015. Technology Innovation and Adoption in Oil & Gas Industry -- Why Did It Slow? *Forbes Energy,* [Online] Available at: <https://www.forbes.com/sites/drillinginfo/2015/07/14/technology-innovation-and-adopiton-in-oil-gas-industry-why-did-it-slow#7326f6763dlc> [Accessed 10 October 2017]

13. Baker, D. and Hunter, R., 2002. *Guide book to Decision Making Methods.* USA: Department of Energy.

14. Bandura, A., 1977. *Social Learning Theory*. Englewood, NJ: Prentice Hall.

15. Banerjee, A.V., 1992. A Simple Model of Herd Behavior. *The Quarterly Journal of Economics,* 107(3), pp. 797-817.

16. Barghout, G., 2017. Disruptive Technologies can be the savior the oil industry seeks. *Europe and Middle East outlook,* [Online] Available at: < http://www.emeoutlookmag.com/news/disruptive-technologies-could-be-saviour-the-oil-industry-seeks> [Accessed 29 January 2017]

17. Barnett, E. and McKeown, L., 2012. The student behind the avatar: using second life for legal advocacy skills development and assessment for external students – A critical evaluation. *Journal of Common Wealth Law and Legal Education,* 8(2), pp. 44-63.

18. Barton, D.L., 2008. Implementation Characteristics of Organizational Innovations: Limits and Opportunities for management strategies. *Communication Research*, 15(5), pp. 603-631.

20. Bass, F., 1969. A new product growth for model consumer durables. *Management Science*, 15(5), pp. 215-227.

21. Bayus, B.L., 1987. Forecasting Sales of New Contingent Products: An Application to the compact disc market. *The Journal of Product Innovation Management,* 4(4), pp. 243-255.

22. Bhargava, S.C., Kumar, A. and Mukherjee, A., 1993. A Stochastic Cellular Automatic Model of Innovation Diffusion. *Technological Forecasting and Social Change*, 44(1), pp. 87-97.

23. Black, J.S. and Gregersen, H.B., 2003. *Leading Strategic Change: Break through the Barrier*. New York: Prentice Hall.

24. Blair, R., 2016. Oil, Gas, Big Data & Big Changes - Big data is making big changes at the pump. *Innovation Enterprise,* [Online] Available at: <https://channels.theinnovationenterprise.com/articles/oil-gas-big-data-and-big-changes> [Accessed 27 September 2017]

25. Bower, J.L. and Christensen, C.M., 1995. Disruptive Technologies: Catching the Wave. *Harvard Business Review,* 73(1), pp. 43-45.

26. Boyd, R. and Richerson, P.J., 1985. *Culture and the Evolutionary Process.* Chicago: University of Chicago Press.

27. BP Technology Outlook, 2017. *BP Technology Outlook - Technology choices for a secure, affordable.* [pdf] Available at: <http://www.bp.com/content/dam/bp/pdf/technology/bp-technology-outlook.pdf> [Accessed 28 August 2017]

28. Braddock, R., 1958, An extension of the "Laswell Formula". *Journal of Communication*, 8(2), pp. 88-93.

29. Brooks, H., 1982. Social and Technological Innovation. In: S.B. Lundsted and E.W Colglazier, eds. 1982. *Managing Innovations*. New York: Pergamon Press.

30. Brown, T., 2009. *Change by Design: How design thinking transforms organizations and inspires innovations*. Canada: Haper Collins

31. Callon, M., 1980. Struggles and Negotiations to Define What is Problematic and What is Not. In: K.D. Knorr, R. Krohn and R. Whitley, eds. 1980. *Sociology of Sciences*. Dordrecht: Reidel Publishing Company. pp. 198-218

32. Carter, L. and Belanger, F., 2005. The utilization of e-government services: citizen trust, innovation and acceptance factors. *Information Systems Journals*, 15(1), pp. 5-25.

33. Casalo, L.V., Flavian, C., Guinaliv, M., 2012. Determinants of the intention to participate in firm hosted online travel communities and effects on consumer behavior intentions. *Tour management*, 31, pp. 898-911.

34. Caselli, F. and Coleman, W.J., 2001. Cross Country Technology Diffusion: The Case of Computers. *The American Economic Review,* 19(2), pp. 328-335.

35. Casetti, E., 1979. Why Do Diffusion Processes Conform to Logistic Trends. *Geographical Analysis*, 1, pp.101-105

36. Chatterjee, R.A. and Eliashberg, J., 1990. The Innovation Diffusion Process in a Heterogeneous Population. A Micro modeling approach. *Management Science,* 36(9), pp. 1057-1079.

37. Chong, A.Y., Lin, B. and Raman, M., 2009. Factors affecting the adoption level of e-commerce: An empirical study. *Journal of Computer Information Systems*, 50(2), pp. 13-20.

38. Choudhry, H., Mohammad, A., Tan, K.T. and Ward, R., 2017. The next frontier for digital technologies in Oil and Gas. *Mckinsey,* [Online] Available at: <http://www.mckinsey.com/industries/oil-and-gas/our-insights/the-next-frontier-for-digital-technologies-in-oil-and-gas> [Accessed 14 September 2017]

39. Christia, J., 2000. *The effects of alliance image on the relationship between consumer innovativeness and new product adoption*. PhD. Oklahoma State University.

40. CIPD, 2016. *Hiring in UAE hit by low oil prices and dwindling business confidence.* [Online] Available at: http://www.cipd.ae/people-management-magazine/hr-news-opinion/uae-hiring-hit [Accessed 02 February 2017]

41. Clark, W., 1923. *Man and Culture*. New York: Thomas and Crowell Company.

42. Clemons, E.K., Gao, G.G. and Hitt, L.M., 2006. When online Reviews Meets Hyper Differentiation: A study of the Craft Beer Industry. *Journal of Management Information Systems*, 23(2), pp. 149-171.

43. Coale, A.J., 1973. The demographic transition reconsidered. *International Population Conference*, 1973. Liege, Belgium.

44. Collan, M., 2007. Lazy User Behavior. *Munich Personal RePEc Archive,* 4330, pp, 1-6.

45. Constas, J., 2017. Exciting times in oilfield technology. *Oil & Gas Financial Journal*, [Online] Available at: < http://www.ogfj.com/articles/print/volume-14/issue-3/features/exciting-times-in-oilfield-technology.html> [Accessed 05 March 2017]

46. Cooper, R.B. and Zmud, R.W., 1990. Information Technology implementation research: A technological diffusion approach. *Management Science,* pp. 123-139.

47. Cresswell, J.W., 1998. *Qualitative Inquiry and Research Design: Choosing among five traditions.* Thousand Oaks, CA: Sage.

48. Creswell, J. W., 2003. *Research design: Qualitative, quantitative and mixed methods approaches.* Thousand Oaks, CA: Sage Publications.

49. Crouch, M. and McKenzie, H., 2006. The logic of small samples in interview-based. *Social Science Information Sur Les Sciences Sociales - SOC SCI INFORM*, 45, pp. 483-499.

50. Daft, R.L. and Lengel, R.H., 1986. Organizational Information Requirements, Media Richness and Structural Design. *Management Science*, 32, pp. 534-571.

51. Dasgupta, S., Agarwal, D. and Gopalakrishnan, S., 1999. Determinants of Information Technology adoption: an extension of existing models of firms in a developing country. *Journal of Global Information Management,* 7(3), pp. 30-40.

52. David, P.A., 1990. The dynamo and the computer: An historical perspective on the modern productivity paradox. *American Economic Review,* 80(5), pp. 355-361.

53. Davis, F.D., 1989. Perceived usefulness, Perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13(3), pp. 319-340.

54. Davis, F.D., Bagozzi, R.P. and Warshaw, P.R., 1989. User acceptance of computer technology: A comparison of two theoretical models. *Management Science,* 35, pp. 982-1003.

55. DeKempe, M.G., Parker, P.M. and Sarvary, M., 2000. Staged Estimation of International Diffusion Models: An application to global cellular telephone adoption. *Technological forecasting and social change,* 57(1), pp. 105-132.

56. Delone, W. and McLean, E.R., 1992. Information Systems Success: The quest for the dependent variable. *Information Systems Research,* 3(1), pp. 60-95.

57. Deng, J., 1982. The Control Problems of Grey Systems. *Systems and Control Letters*, 5(1), pp. 288-294.

58. Dervin, B., 1983. An Overview of Sense Making Research: Concepts, Methods and Results to Date. In: *International Communication Association Annual Meeting*. May 1983. Dallas.

59. Diederen, P., Meilj, H.V. and Wolters, A., 2003. Innovation adoption in agriculture: Innovators, early adopters and laggards. *Cahlers d' Economie et de Sociologie Rurales*, 67, pp. 29-50.

60. Dimaggio, P.J. and Powell, W.W., 1983. The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review,* 48(2), pp. 147-160.

61. Dixit, A.K., Dixit, R.K. and Pindyck, R.S., 1994. *Investment under uncertainty*. USA: Princeton University Press.

62. Dixon, R.R., 1928. *The building of cultures.* New York: Charles Scribner's Sons.

Dodson, J.A. and Muller, E., 1978. Models of New Product Diffusion Through Advertising and Word-of-Mouth. *Management Science*, 24, pp. 1568-1578

63. Dolan, R.J. and Jeuland, A.P., 1981. Experience Curves and Dynamic Demand Model Implications for Optimal Pricing Strategies. *Journal of Marketing*, 45, pp. 52-62.

64. Dowling, G.R. and Midgley, D.F., 1978. The Decision Process Model of Antartic Travel Innovator. Austalian Journal of Management, 3(2), pp. 148 - 160

65. Duesenberry, J., 1949. *Income, Saving and the Theory of Consumer Behavior*. Cambridge: Harvard University Press.

66. E&Y, 2017. *Why it's time to invest in digital oil?* [Online] Available at: http://www.ey.com/us/en/industries/oil---gas/ey-why-the-time-is-right-for-digital-oil-companies [Accessed 20 September 2017]

67. Eagly, A.H. and Chaiken, S., 1963. The *Psycology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.

68. Edison, H., Ali, N.B., Torkan, R., 2013. Towards Innovation Measurement in the Software Industry. *Journal of Systems and Software*, 86(5), pp. 1390-1407.

69. Ellefsen, T., 2017. Oil & Gas Industry slowly and surely adapting to demands of modern times. *Energy CIO Insights,* [Online] Available at: <https://smart-grid.energycioinsights.com/cxo-insights/oil-and-gas-industry-slowly-and-surely-adapting-to-demands-of-modern-times-nwid-46.html> [Accessed 01 August 2017]

70. Ellison, G. and Drew, F., 1991. Knife – Edge or Plateau. When do market models tip? *Quarterly Journal of Economics*, 118(4), pp. 1249-1278.

71. Ene, A., 2016. How Technology is changing the Oil & Gas landscape – for the better. *Energy CIO Insights,* [Online] Available at: < https://smart-grid.energycioinsights.com/cxo-insights/how-technology-is-changing-the-oil-and-gas-landscape-for-the-better-nwid-51.html> [Accessed 26 February 2017]

72. Farrel, J. and Saloner, G., 1985. Standardization, Compatibility and Innovation. *RAND Journal of Economics,* 16(1), pp. 70-83.

73. Fayad, W., 2016. Innovation a must to remain resilient. *Arabian Oil and Gas,* [Online] Available at: <http://www.arabianoilandgas.com/article-15418-innovation-a-must-to-remain-resilient/> [Accessed 04 July 2017]

74. Feichtinger, H.G., 1985. Banach Spaces of Distribution Defined by Decomposition Methods. *Math. Nachr.* 123(1), pp. 97-120.

75. Festinger, L., 1957. *A theory of cognitive dissonance.* Evanston, IL: Row and Peterson.

76. Fildes, R. and Goodwin, P., 1998. Judgmental Forecast of time series affected by special events: Does providing a statistical forecast improve accuracy? *Journal of Behavioral Decision Making*, 12, pp. 37-53.

77. Fishbein, M. and Ajzen, I., 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison - Wesley

78. Fraj, E. and Martinez, E., 2006. Environmental Values and Life Syles as determining factors of ecological consumer behavior: an empirical analysis. *Journal of Consumer Marketing,* 23(3), pp. 133-144.

79. Frambach, R.T. and Schilleweart, N., 2002. Organizational Innovation Adoption: A Multi-Level framework of determinants and opportunities for future research. *Journal of Business Research*, 55(2), pp. 153-176.

80. Frobenius, L., 1898. *Der Westafrikanische Kulcurkreis.* Illinois: University of Illinois Press.

81. Gartner, 2016. *Gartner's 2016 Hype Cycle for emerging technologies identifies three key trends that organizations must track to gain competitive advantage.* [Press Release] 16 August 2016. Available at:< http://www.gartner.com/newsroom/id/3412017> [Accessed 01 June 2017]

82. Gartner, 2016. *Top 10 Technology Trends Impacting the Oil & Gas Industry in 2017.* [Online] Available at:< https://www.gartner.com/doc/2695918/top--technology-trends-impacting> [Accessed 06 September 2017]

83. Gates, B., 1998. *Senate Hearing.* Interviewed by Senate. [Paper]. USA, 03 March 1998.

84. Gaudet, H. Berelson, B. and Lazarsfeld, P.F., 1944. *The People's Choice*. New York: Duell, Sloan and Pearce.

85. Gelb, E. and Voet, H., 2009. ICT Adoption trends in agriculture: a summary of the EFITA ICT adoption questionnaires. *EFITA Conference 2009 Proceedings*, pp. 901-909.

86. Gladwell, M., 2000. *The Tipping Point.* USA: Little, Brown and Company.

87. Glaser, B.G. and Strauss, A.L., 1967. *The discovery of grounded theory. Strategies for qualitative research*. Chicago: Aldine.

88. Godae, P. and Johansen, T.S., 2012. Understanding adoption of new technologies: Technology readiness and acceptance as an integrated concept. *Journal of European Psychology Students*, 3(1), pp. 38-52.

89. Godinho, M.W. and Fagerberg, J., 2003. *Innovation and Catching up.* Oslo: Centre for Technology, Innovation and Culture, University of Oslo.

90. Goldenberg, J., Libal, B., Soloman, S., Jan, S. and Stauffer, D., 2001. Marketing Percolation. *Physica*, 284(1), pp. 335-347.

91. Golder, P.N. and Tellis, G.J., 1998. Beyond Diffusion: An affordability model of the growth of new consumer durables. *Journal of Forecasting,* 17, pp. 259-280.

92. Goodhue, D.L. and Thompson, R.L., 1995. Task – Technology Fit and Individual Performance. *MIS Quarterly,* 19(2), pp. 213-236.

93. Graebner, F., 1911. *Methode der Ethnologie*. Heidelberg: Carl Winter.

94. Granovetter, M., 1978. Threshold Models of Collective Behavior. *American Journal of Sociology, 83(5), pp.* 489-515

95. Greenwood, J. and Yorokolgu, M., 1997. 1974. *Carnegie Rochester Conferences Series on Public Sector Policy*, 46, pp. 49-95.

96. Gregg, J.V., Hassel, C.H. and Richardson, J.T., 1964. *Mathematical Trend Curves: An aid to forecasting.* Edinburgh: Oliver and Boyd.

97. Griliches, Z., 1957. Hybrid corn: An exploration in the economics of technological change. *Econometrica,* 25(4), pp. 501-522.

98. Gross, S., 2017. Energy Innovation does not stop when oil prices are low. *Brookings,* [Online] Available at: < https: // www.brookings.edu / blog / planetpolicy / 2017 / 03 / 15/ energy-innovation-doesnt-stop-when-oil-prices-are-low/> [Accessed 15 Nov 2018]

99. Gruber, H. and Verboven, F., 2001. The Diffusion of Mobile Telecommunications Services in the European Union. *European Economic Review,* 45(3), pp. 577-588.

100. Guest, G., Bunce, A., and Johnson, L., 2006. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods*, *18*(1), pp. 59–82.

101. Gustafson, R., 1986. Human Physical Aggression as a function of frustration: Role of Aggressive Cues. *Psychological Reports,* 59(1), pp. 103-110.

102. Hagerstrand, T., 1965. A Monte Carlo Approach to Diffusion. *Archives Europeennes de Sociologie,* 6(1), pp. 43-67.

103. Hahn, F., 1994. On growth theory. *Quaderns De Dipartmento Di Economia Politica,* 167.

104. Hall, G.E. and Hord, S.M., 1987. *Challenges in Schools: Facilitating the Process*. Albany: State University Press.

105. Hampel, M., 2014. Oil and Gas industry slow in adopting new technology. *Cybera,* [Online] Available at: <https://www.cybera.ca/news-and-events/tech-radar/oil-and-gas-industry-slow-in-adopting-new-technology/> [Accessed 09 September 2017]

106. Haunschild, P.R. and Miner, A.S., 1997. Modes of interorganizational imitation: The effects of outcome salience and uncertainty. Administrative Science Quarterly, 42(3), pp. 472-500.

107. Hauser, J.R. and Wisniewski, K.J., 1982. Application, Predictive Test and Strategy Implications for a Dynamic Model of Consumer Response. *Marketing Science,* 1(2), pp. 143-179.

108. Hays, S.P., 1996. Influences on Re-Invention During the Diffusion of Innovations. *Political Research Quarterly*, 49(3), pp. 631-650.

109. Henderson, R.M. and Clark, K.B., 1990. Architectural Innovation: The Reconfiguration of Existing. *Administrative Science Quarterly,* 35(1), pp. 9-30.

110. Heps, V. and Rosendhal, T. eds., 2012. Integrated Operations in the Oil & Gas Industry: Sustainability & Capability development. Business Science Reference.

111. Hodas, N.O. and Lerman, K., 2014. The simple rules of social contagion. *Sci. Rep.,* 4, pp. 43-54.

112. Homer, J., 1987. A Diffusion model with application to evolving medical technologies. *Technological Forecasting and Social Change,* 31(3), pp. 197-218.

113. Hong, S., Labe, R.P. and Bayus, B.L., 1989. Developing and using forecasting models of consumer durables: The case of color television. *The Journal of Product Innovation Management,* 6(1), pp. 5-19.

114. Horsky, D. and Simon, L.S., 1983. Advertising and the diffusion of new products. *Marketing Science,* 2(1), pp. 1-10.

115. Horsky, D., 1990. A Diffusional Model Incorporating Product Benefits, Price, Income and Information. *Marketing Science*, 9(4), pp. 279-365.

116. Igbaria, M., Parasuraman, S. and Baroudi, J.J., 1996. A Motivational Model of Micro Computer Usage. *Journal of Management Information System*. 13(1), pp. 127-143.

117. Inter Nations, 2017. *Not Just Petrodollars - The UAE economy* [Online] Available at: <https://www.internations.org/uae-expats/guide/18931-economy-finance/not-just-petrodollars-the-uae-economy-18916> [Accessed 10 May 2017]

118. Jain, D. and Rao, R.C., 1990. Effects of price on the demand for durables: Modelling, estimation and findings. *Journal of Business Economics and Statistics.* 8(2), pp. 163-170.

119. Jarvis, R. and Goddard, A., 2016. An analysis of common cause of major losses in the onshore oil, gas and petrochemical industries. *Lloyd's Market Association,* [pdf] Available at: <https://www.lmalloyds.com/LMA/Underwriting/Non-Marine /Onshore_Energy/ OnshoreEnergy_Wordings/Common_Causes_of_Losses_in_the_Oil%20_Petro_I ndustry.aspx> [Accessed 17 September 2017]

120. Jenkins, D.H., 1949. Social Engineering in Educational Change: An Outline of Method. *Progressive Education*, 26(7), pp. 193-197.

121. Judah, J., 2017. "Disruptive" Technology. *Journal of Petroleum Technology,* [Online] Available at: <https://www.spe.org/en/jpt/jpt-article-detail/?art=2555> [Accessed 27 January 2017]

122. Kaine, G., Beswell, D. and Linehan, C., 2004. *Value Challenging Innovation in Agriculture.* Victoria, Australia: Department of Primary Industries.

123. Kalish, S., 1985. A new product adoption model with prices, advertising and uncertainty. *Management Science,* 13(12), pp. 1569 – 1585.

124. Kamukara, W.A., and Balasubramanian, S., 1988. Long Term View of the Diffusion of durables. A study of the Role of price and adoption influence processes via Tests of Nested Models. *International Journal of Research in Marketing,* 5, pp. 1-13.

125. Kano, N. and Nobuhiku, S., 1984. Attractive Quality and Must be Quality. *Journal of the Japanese Society for Quality Control,* 14(2), pp. 39-48.

126. Kaun, K.K. and Chau, P.Y., 2001. A Perception based model for EDI adoption in small business using a technology-organization-environment frame work. *Journal of Information and Management,* 38(8), pp. 507-521.

127. Keller, J.M. and Suzuki, K., 2014. Use of ARCS motivation model in course ware design. In: D.H. Jonassen, ed. 2014. *Instructional Design for Micro Computer Usage*. Hillsade NJ: Lawrance Erlbaum.

128. Keller, K.L. and Forehand, M., 1996. Initial Retrieval Difficulty and Subsequent Recall in an advertising setting. Journal of Consumer Psychology, 5(4), pp. 299-323.

129. Kennickell, A.B. and Kwast, M.L., 1997. Who uses electronic banking? Results from the 1995 survey of consumer finance. *Proceedings from the 33rd Annual Conferences on Bank Structure and Competition*, pp. 56-75.

130. Keystone Energy Tools, 2017. *Is there a lack of Innovation in the Oil and Gas Industry?* [Online] Available at: <http://keystoneenergytools.com/blog/is-there-a-lack-of-innovation-in-the-oil--gas-industry> [Accessed 25 July 2017]

131. Kim, N., Chang, D.R. and Shocker, A.D., 2000. Modeling Inter Category and Generational Dynamics for a growing information technology industry. *Management Science,* 46(4), pp. 496-512.

132. Kotler, P., 1971. Metamarketing: The Furthering of Organizations, Persons, Places and Causes. *Marketing Forum,* 8, pp. 13-23.

133. Kroeber, A.L., 1940. Stimulus Diffusion. *American Anthropologist*, 42(1), pp. 1-20.

134. Kwon, T.H. and Zmud, R.W., 1987. Unifying the fragmented models of information systems implementation. In: *Critical Issues in Information System Research.* New York: John Wiley and Sons. pp. 227-251.

135. Lacovou, C.L., Benbasat, I and Dexter, A.S., 1995. Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly,* 19(4), pp. 465-485.

136. Latham, A., 2003. Research, Performance, and Doing Human Geography: Some Reflections on the Diary-Photograph, Diary-Interview Method. *Environment and Planning A: Economy and Space*, *35*(11), pp. 1993–2017

137. Lazarsfeld, P.F. and Merton, R.K., 1948. Mass communication, popular task and organized social action. In: W. Sahramm and D.F., Roberts, eds. *The process and effects of mass communication.* Urbana and Chicago, IL: University of Illinois Press.

138. Lazarsfeld, P.F., 1944. *How the voter makes up his mind in a presidential campaign.* New York: Columbia University Press.

139. Lehman, D.R. and Weinberg, C.B., 2000. Sales through sequential distribution channels: an application to movies and videos. *Journal of Marketing.* 64(3), pp. 18-33.

140. Leonardo, B. and Drazen, A., 1997. Capital Account Liberalization as a signal. *American Economic Review*, 87(1), pp. 138-154.

141. Levinthal, D.A. and Cohen, W.M., 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly,* 35(1), pp. 128-152.

142. Lewin, K., 1947. *Field Theory in Social Science.* New York: Harpen and Row.

143. Libermann, Y. and Paroush, J., 1982. Economic aspects of diffusion process. *Journal of Economics and Business,* 34, pp. 95-100.

144. Libertore, M. and Bream, D, 1997. Adoption and implementation of digital imaging technologies in the banking and insurance industries. *IEEE Transactions on Engineering Management*, 44, pp. 367-377.

145. Lilien, G., 1980. The implications of diffusion models for accelerating the diffusion of innovation. *Technological Forecasting and Social Change,* 17(1), pp. 340-350.

146. Lilien, G.L. and Yoon, E., 1990. The timing of competitive market entry: An exploratory study on new industrial products. *Management Review,* 36(5), pp. 568-585.

147. Lindzey, G. and Aronson, E., 1985. *The Hand Book of Social Psychology.* Mass: Addison Wesley Publishing Company.

148. Linton, R., 1936. *The study of man: An introduction.* Oxford, England: Appleton-Century.

149. Lloyd's Register, 2017. *The Lloyd's Register Technology Radar – Low Carbon.* London: Lloyd's Register.

150. Lowry, C.S. and Fienan, M.N., 2013. Crowdhydrology: Crowd sourcing hydrologic data and engaging citizen scientist. *Ground Water*, 51(1), pp. 151-156.

151. Luque, A., 2002. An option value approach to technology adoption in US manufacturing: Evidence from micro-data. *Economics of Innovation and New Technology*, 11(2), pp. 543-568.

152. Lynch, J.G. and Wood, S.L., 2002. Prior Knowledge and Complacency in New Product Learning. *Journal of Consumer Research*, 29(3), pp. 416-426.

153. Maceda, C., 2015. Job cuts reported in Oil & Gas industry in UAE. *Gulf News*, [Online] 30 July 2015. Available at: < http://gulfnews.com/business/sectors/employment/job-cuts-reported-in-oil-and-gas-industry-in-uae-1.1558545> [Accessed 03 March 2017]

154. Mahajan, V., Muller, E. and Kerin, R.A., 1984. Introduction Strategy for New Products with Positive and Negative Word of Mouth. *Management Science*, 30(12), pp. 1389-1404.

155. Mahajan, V., Wind, Y. and Muller, E., 2000. *New Product Diffusion Models.* London: Kluwer Academic.

156. Mahler, A. and Rogers, E.M., 1999. The diffusion of interactive communication innovation and the critical mass: the adoption of telecommunication services by German banks. *Telecommunication Policy,* 23(10), pp. 719-740.

157. Malhotra,Y., and Galletta, F.D., 1999. Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Emprical Validation. In: IEEE, *Proceedings of the 32nd Hawaii International Conference on system Sciences.* Hawaii, 1999, Hawaii: IEEE

158. Malterud, K., Siersma, V.D. and Guassora, A.D., 2015. Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qualitative Health Research*, 26, pp. 1753-1760.

159. May, C.R., 2009. Development of a Theory of Implementation and Integration: Normalization Process Thoery. *Implementation Science*, 4(29), pp. 103-125.

160. McLeod, S., 2008. *Cognitive Dissonance.* [Online] Available at: <http://www.simplypsychology.org /cognitive-dissonance.html> [Accessed 02 March 2018]

161. Miller, M.J., 2012. Is technology working? Eric Schmidt & Peter Theil Disagree. *PC Magazine,* [Online] Available at:<http://forwardthinking.pcmag.com/show-reports/300403-is-technology-working-eric-schmidt-and-peter-thiel-disagree> [Accessed 03 October 2016]

162. Minsky, M., 1986. *The Society of Mind.* New York: Simon and Schuster.

163. MOE, 2015. *The Annual Economic Report 2015*. Abu Dhabi: MOE

164. Moore, G., 2002. *Crossing the Chasm: Marketing and Selling Technology Products to Main Stream Customers*. New York: Harper Collins.

165. Morse, J., 1998. Designing Funded Qualitative Research. In: N. Denzin, and Y. Lincoln, eds. 1998. *Strategies of Qualitative Inquiry.* Thousand Oaks, CA: Sage Publication. pp. 56-85.

166. Mowery, D.C., Oxley, J. and Silverman, B., 1998. Technological overlap and inter firm cooperation: Implications for the resource based view of the firm. *Research Policy,* 27(5), pp. 507-523.

167. National Petroleum Council Report, 2007. *Oil and Gas Technology Development.* Washington: National Petroleum Council Report.

168. Nechully, S., Pokhriyal, S.K. and Thomas, S. E., 2018. A Journey through Evolution of Theories and Models of Adoption of Innovations (Year: 1798-1980). *International Journal of Mechanical Engineering and Technology*, 9(10), pp. 1–36

169. Nechully, S., Pokhriyal, S.K. and Thomas, S. E., 2018. A Journey through Evolution of Theories and Models of Adoption of Innovations (Year: 2000-2018). *International Journal of Production Technology and Management*, 9(2), pp. 31-73

170. Nechully, S., Pokhriyal, S.K. and Thomas, S. E., 2018. A Journey through Evolution of Theories and Models of Adoption of Innovations (Year: 1981-1999). *Journal of Management*, 5(5), pp. 97-143

171. Nechully, S., Pokhriyal, S.K. and Thomas, S. E., 2018. Significance of Innovative Technologies in Oil and Gas Sector. *International Journal of Mechanical Engineering and Technology*, 9(10), pp. 236-252

172. Nechully, S., Pokhriyal, S.K., Thomas, S.E. and Koyadan, S., 2019. FrameWork Analysis (Stage 1): Creating a Frame work to Enhance the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas. *International Journal of Mechanical Engineering and Technology*, 10(4), pp. 107-125.

173. Nechully, S., Pokhriyal, S.K., Thomas, S.E. and Koyadan, S., 2019. Frame Work Analysis (Stage 2): Creating a Frame Work to Enhance the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas. *International Journal of Mechanical Engineering and Technology*, 10(4), pp. 126-141.

174. Nechully, S., Pokhriyal, S.K., Thomas, S.E. and Koyadan, S., 2019. Frame Work Analysis (Stage 3): Creating a Frame Work to Enhance the Adoption of

Innovative Drilling Technologies in Upstream UAE Oil and Gas. *International Journal of Mechanical Engineering and Technology*, 10(5), pp. 105-124.

175. Nechully, S., Pokhriyal, S.K., Thomas, S.E. and Koyadan, S., 2019. Frame Work Analysis (Stage 4): Proposing a Validated Frame Work to Enhance the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas. *International Journal of Mechanical Engineering and Technology*, 10(5), pp. 125-142.

176. Nechully, S. and Pokhriyal, S.K., 2019. Identifying the Relevant Variables Affecting the Adoption of Innovative Drilling Technologies in Upstream UAE Oil and Gas. *International Journal of Advanced Research in Engineering and Technology*, 10(2), pp. 542-563

177. Neumann, J.V. and Burks, A.W., 1966. *Theory of Self Reproducing Automata.* IL, USA: University of Illinois Press Champaign.

178. Ngambi, D. and Bozalek, V., 2013. Leveraging Informal leadership in higher education institutions: A case of diffusion of emerging technologies in a Southern context. *British Journal of Educational Technology*, 44(6), pp. 940-950.

179. Norris, C.A. and Soloway, E., 2011. Learning and Schooling in the age of Mobilism. *Educational Technology*, 11, pp. 3-10.

180. Norton, J.A. and Bass, F.M., 1987. A Diffusion Theory Model of Adoption and Substitution for Successive Generations of High Technology Products. *Management Science,* 33(9), pp. 1069-1086.

181. Nowak, M.A. and May, R.M., 1992. Evolutionary Games and Spatial Chaos. *Nature*, 359, pp. 826-829.

182. Ocean News & Technology, 2017. *Oil and Gas Industry accelerates Technological Innovations during Downturn.* [Online] Available at: <https://www.oceannews.com/featured-stories/oil-and-gas-industry-accelerates-technological-innovations-during-downturn> [Accessed 27 January 2017]

183. OECD, 2005. *The OECD Innovation Strategy – 2015 Revision.* [Online] Available at: <www.oecd.org/innovation/innovation-imperative. htm > [Accessed 02 February 2018]

184. Oliver, P.E. and Myers D.J., 2001. The Co-evolution of social movements. *Mobilization: An International Journal*, 8(1), pp. 1-24.

185. Oliver, R.L., 1980. A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions, Journal of Marketing Research, 17(4), pp. 460 - 461

186. Parasuraman, A., 2000. Technology Readiness Index: A multiple Item scale to measure readiness to embrace new technologies. *Journal of Service Research*, 2(4), pp. 307-320.

187. Parmentola, A., Simoni, M. and Tutore, I., 2018. Fast and Furious: how the open Vs closed dilemma affects the technology diffusion dynamics. *Management Decision*, 56(4), pp. 867-890.

187. Patton, M. Q., 2002. *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage Publications.

188. Paudel, K., Pandit, M., Mishara, A. and Segarra, E., 2011. Why don't farmers adopt precision farming technologies in cotton production? In: *2011 Agricultural and Applied Economics Association Annual meeting.* Pittsburg, 24-26 July 2011. Pennsylvania: Agriculture and Applied Economics Association.

189. Perry, W.J., 1935. *The primordial ocean. An introductory contribution to social psychology*. York: Methuen and Company Limited.

190. Puentedura, R.R., 2006. Learning, Technology and the SAMR Model: Goals, Processes and Practice. *Review of Educational Research*, 76(3), pp. 40-62.

191. PWC, 2017. *From Technology adopters to innovators: How R&D can catalyze innovation in Middle East National Oil Companies.* [Online] Available at:<https://www.strategyand.pwc.com/me/home/thought_leadership_strategy/reports_and_white_papers_me/display/technology-adopters> [Accessed 18 March 2017]

192. Radas, S. and Shugan, S., 1998. Seasonal Marketing and Timing New Product Introduction, *Journal of Marketing Research*, 35(3), pp. 296-315.

193. Ram, S., 1987., A model of innovation resistance. *Advances in Consumer Research*, 14, pp. 208-212.

194. Randall, L.M. and Coakley, L.A., 2007. Applying adaptive leadership to successful change initiatives in academia. *Leadership and Organizational Development Journal*, 28(4), pp. 325-335.

195. Rayna, T and Striukova, L., 2009. The curse of the first mover: when incremental innovation leads to radical change. *International Journal of Collaborative Enterprise,* 1(1), pp. 4-21.

196. Reichardt, M. and Jurgen, C., 2009. Adoption and Perspective of Precision farming in Germany: Results of several surveys among the different agricultural target groups. *Precision Agriculture*, 10(1), pp. 73-94.

197. Reinsvold, C., 2016. *Oil & Gas Technology trends through 2020.* [LinkedIn] 02 February. Available at: <https://www.linkedin.com/pulse/oil-gas-technology-trends-through-2020-chris-reinsvold> [Accessed 01 March 2017]

198. Rice, R.E. and Rogers, E. M., 1980. Reinvention in the Innovation Process. *Knowledge Creation, Diffusion, Utilization,* (4), pp. 499-514.

199. Rigzone, 2017. Cost reduction, Greater Efficiency focus of technology in 2017. *Rigzone,* [Online] Available at: < http://www.rigzone.com/news/oil_gas/a/148019/cost_reduction_greater_efficiency_focus_of_technology_in_2017> [Accessed 02 January 2017]

200. Ritchie, J. and Spencer, L., 1994. Qualitative data analysis for applied policy research. In A.Bryman and R. G. Burgess, eds. 1994. *Analyzing qualitative data*. London: Routledge. pp. 173-194

201. Ritz, C.J. and Morgan, J.J., 1991. Incorporating distribution into new product diffusion models. *International Journal of Research in Marketing,* 8(6), pp. 91-112.

202. Robertson, T. S., 1971. *Innovative Behavior and Communication.* New York: Rhineart and Winston.

203. Rogers, E.M., 1962. *Diffusion of Innovations.* New York: Free Press of Glencoe.

204. Roling, N., 1988. *Extension Science: Information Systems in Agricultural Developments.* Cambridge: Cambridge University Press.

205. Rosenberg, N., 1972. Factors affecting the diffusion of technology. *Exploration in Economic History*, 10(1), pp. 3-33.

206. Russel, J., 1980. A Circumplex Model of Affect. Journal of Personality and Social Psychology, 39, pp. 1161-1178.

207. Ruyter, K.D., Wetzels, M. and Kleijnen, M., 2001. Customer adoption of e-services: an empirical study. *Marketing Letters,* 15(1), pp. 21-36.

208. Ryan, B. and Gross, N.C., 1943. The diffusion of hybrid seed corn in the two Lowa communities. *Rural Sociology,* 8(1), pp. 15-24.

209. Saadi, D., 2014. Regional Oil and Gas producers urged to get up to speed up on innovation technologies. *The National,* [Online] 1 June. Available at: <https://www.thenational.ae/business/regional-oil-and-gas-producers-urged-to-get-up-to-speed-on-it-1.279106> [Accessed 29 May 2017]

210. Saha, A., Love, H.A., Schwart, R., 1994. Adoption of Emerging Technologies under Output Uncertainty. *American Journal of Agriculture Economics*, 76, pp. 836-846.

211. Samuelson, P.A., 1938. A note on the pure theory of consumer behavior. *Economica*, 5(17), pp. 61-71.

212. Sawyer, J.D., 2016. Oil & Gas Producers Need Technology, Innovation. *Advanced Manufacturing,* [Online] Available at: <http://advancedmanufacturing.org/oil-gas-producers-need-technology-innovation-2/> [Accessed 10 October 2017]

213. Scherer, M.J., 1986. *Values in the creation, prescription and use of technological aids and assistive devices for people with physical disabilities*. PhD. University of Rochester.

214. Schmidt, G.M. and Druchl, C.T., 2005. Changes in Product Attributes and Cost as Drivers of New Product Diffusion and Substitution. *Product and Operations Management*, 14, pp. 272-285.

215. Schmidt, G.M. and Porteus, E.L., 2000. The impact of an integrated marketing and manufacturing innovation. *Manufacturing and service operations management.* 2(4), pp. 415-423.

216. Schmidt, W., 1906. Die Mon Khmer Volker ein biodeglied zwischen volkern zentralaslens und anstronesiens. *Archiv Fur Anthropologie,* 5, pp. 59-109.

217. Schumpeter, J., 1942. *Capitalism, Socialism and Democracy.* New York: Harper and Brothers.

218. Scott, W.R. and Christensen, S., 1995. *The Institutional Construction of Organization*. Thousand Oaks, Calif: Sage

219. Shane, S., 2008. *The Hand Book of Technology and Innovation Management.* New York: Wiley-Black Well.

220. Sharif, M.N. and Ramanathan, K., 1981. Binomial Innovation Diffusion Models with Dynamic Potential Adopter Population. *Technological Forecasting and Social Change*, 20, pp. 63-87.

221. Silva, V., Lira, M. and Pereira, V., 2001. Nutritive Value and Voluntary intake of rubber bush. *Pasturas Tropicales*, 23(2), pp. 20-23.

222. Simon, H. and Sebastian, K.H., 1987. Diffusion and Advertising: The German Telephone Campaign. *Management Science*, 33(4), pp. 451-466.

223. Simon, H.A., 1947. *Administrative Behavior: A Study of Decision – Making Process in Administrative Organization*. New York: The Macmillan Company

224. Slaughter, A. and England, J., 2016. The Arc of Innovation in the Oil and Gas Industry Using US Patent Databases to Track Trends. *Energy Today,* [Online] Available at: < https://www.energytoday.net/economics-policy/energy-today-patent-series-arc-innovation-oil-gas-industry-using-us-patent-databases-track-trends/> [Accessed 14 October 2017]

225. Smith, G.E., 1933. *The Diffusion of Culture*. London: London, Watts and Co.

226. Srivastava, R.K., Leone, R.P. and Shocker, A.D., 1981. Market Structure Analysis: Hierarchical Clustering a Products Based on Substitution in Use. *Journal of Marketing,* 45(3), pp. 38-48.

227. Steffens, P., 1998. Applying Diffusion Models with Regional Heterogeneity. *Marketing Letters*, 9(4), pp. 361-369.

228. Stout, 2014. *Trends and Challenges for the Oil and Gas Industry.* [Online] Available at: <https://www.stoutadvisory.com/insights/article/trends-and-challenges-oil-and-gas-industry> [Accessed 17 August 2017]

229. Strang, D. and Macy, M.W., 2001. In Search of Excellence, Fads, Success stories and Adaptive emulation. *American Journal of Sociology*, 107(1), pp. 147-182.

230. Strang, D. and Soule, S.A., 1998. Diffusion in Organizations and Social Movements: From Hybrid Corn to Poison Pills. *Annual Review of Sociology*, 24, pp. 265-290.

231. Strauss, A. and Corbin, J., 1990. *Basics of qualitative research: grounded theory procedures and techniques*. Thousand Oaks, CA: Sage Publications.

232. Strauss, A., and Corbin, J., 1998. *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage Publications.

233. Sun, B., Neslin, S.A. and Srinivasan, K., 2005. Measuring the impact of promotions on brand switching when consumers are forward looking. *Journal of Marketing Research*, 40(4), pp. 389-405.

234. Sykes, T.A., Venkatesh, V. and Gosain, S., 2009. Model of Acceptance with peer support. A social network perspective to understand employer's system use. *MIS Quarterly,* 32(2), pp. 371-393.

235. Takamul, 2017. *Background of Takamul.* [Online] Available at: < **http://www.takamul.gov.ae/about-takamul/background**> [Accessed 27 March 2017]

236. Tani, J., 1988. Model Based Learning for Mobile Robot Navigation from the Dynamical Systems Perspective. *IEEE Transaction on Systems,* 26(3), pp. 421-436.

237. Tanner, O.C., 1974. *Innovative Technology.* [Online] Available at: < https://www.octanner.com/uk/ why-choose-us/innovative-technology.html> [Accessed 05 June 2018]

238. Taylor, S and Todd, P.A., 1995. Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research,* 6(2), pp. 144-176.

239. Teles, E.O., Tanajura, A.P. and Torres, E.A., 2016. Reactivation of Mature Oilfields: A Multifaceted Production Management. *International Journal of Materials*, 4(1), pp.36-39

240. Teng, J. T., and Thompson, G.L., 1983. Oligopoly models for optimal advertising, *Management Science*, 29, pp. 1087-1101.

241. The Oil and Gas Year, 2015. *The Abudhabi-2015.* [pdf] The Oil & Gas Year. Available at: http: // www.theoilandgasyear.com /content /uploads /2015/01/Preview_TOGY_AbuDhabi_2015.pdf> [Accessed 10 February 2017]

242. Thompson, R.L., Higgins, C.A. and Howell, J.M., 1991. Personal Computing Toward a Conceptual Model of Utilization, *MIS Quarterly*, 15(1), pp. 125-143.

243. Tolbert, P.S. and Zucker, L.G., 1983. Institutional Sources of Change in the Formal Structure of Organizations: The Diffusion of Civil Service reform 1880-1935. *Administrative Science Quarterly*, 28(1), pp. 22-39.

244. Tornatzky, L. G. and Fleischer, M., 1990. *The Process of Technological Innovation*. Lexinton: Lexinton Press.

245.Triandis, H.C., 1977. Interpersonal Behavior. Monterey: Brooke/Cole

246. U.K. Oil and Gas Authority, 2016. *Technology and Strategy*. Aberdeen: U.K. Oil and Gas Authority.

247. UAE Ministry of Cabinet Affairs, 2015. *UAE National Innovation Strategy.* UAE: UAE Ministry of Cabinet Affairs.

248. UAE Ministry of Finance, 2017. *Mohammed Bin Rashid Innovation Fund.* Dubai: UAE Ministry of Finance

249. UAE Trade and Commercial Office, 2017. *Energy: Oil, Gas & Petrochemical Products.* Dubai: UAE Trade and Commercial Office.

250. UAEinteract, 2017. *Oil and Gas – UAE.* [Online] Available at: <http://www.uaeinteract.com/business/oilandgas.asp> [Accessed 09 July 2017]

251. Usuaebusiness, 2019. *The UAE Oil and Gas Sector: Recent Updates.* [pdf] Usuaebusiness. Available t:< http://usuaebusiness.org/wp-content/uploads/2019/01/U.A.E.-Oil-and-Gas-Sector.pdf> [Accesses 03 May 2019]

252. Van De Ven, A.H., Garud, R. and Venkataraman, S., 1999. *The Innovation Journey.* Oxford: Oxford University Press.

253. Varian, H. and Choi, H., 2012. Predicting the present with Google trends. *Economic Record,* 88(1), pp. 2-9.

254. Venkatesh, V. and Davis, F.D., 2000. A Theoretical Extension of the TAM: For longitudinal field studies, *Management Science*, 46(2), pp. 169-332.

255. Vessey, I., 1991. Cognitive Fit: A Theory based analysis of the graphs VS tables' literature. *Decision Sciences,* 22(2), pp. 219-240.

256. Wang, J. and Liu, C., 2010. Licensing a Vertical Product Innovation. *Economic Record,* 86, pp. 603-631.

257. Ward, W.H., 1967. The Sailing Ship Effect. *Bulletin of the Institute of Physics and Physical Society*, 18, pp. 169-170.

258. Weber, M., 1968. *Economy and society: An outline of interpretive sociology*. New York: Bedminster Press.

259. Webster, J. and Wing, L., 2017. Creativity, Knowledge and Innovation in Virtual work. *New Technology, Work and Employment,* 32(1), pp. 1-11.

260. Wenger, E., White, N. and Smith, J.D., 2009. *Digital Habitats: Stewarding Technology for Communities*. Portland: CPsquare.

261. Wiefels, P., 2002. *The Chasm Companion: A Field guide to crossing the chasm and inside the tornado*. New Jersy: Wiley and Sons.

262. Wilson, D.T. and Pelham, A.M., 1996. A Longitudinal study of the impact of market structure, firm structure, strategy and market orientation culture on dimension of small firm performance. *Journal of the Academy of Marketing Science,* 24(1), pp. 27-43.

263. Wilson, T.D., 1981. On user studies and information needs. *Journal of Documentation,* 37(1), pp. 3-15.

264. Wisconsin, 2017. *UAE Oil and Gas Sector.* [Online] Available at:<http://inwisconsin.com/export/market-intelligence/posts/uae-oil-and-gas/> [Accessed 18 March 2017]

265. World Economic Forum, 2017. Shaping the future of Oil and Gas – A breakthrough in mindset and technology. Geneva: World Economic Forum.

266. World Economic Forum, 2018. Competitiveness agendas to reignite growth: Findings from the Global Competitiveness Index. Geneva: World Economic Forum.

267. Xie, J., Sirbu, M. and Song, M., 1997. Kalman Filter Estimation of New Product diffusion models. *Journal of Marketing Research,* 34(3), pp. 378-393.

268. Yapa L.S. and Mayfield, R.C., 1978. Non-adoption of innovations: evidence from discriminant analysis. *Economic Geography*, 54, pp. 145-156

269. Yates, A., 1989. *Control through communication: The rise of system in American Management.* Baltimore: Johns Hopkins University Press.

270. Zaltman, G. and Holbek, J. and Duncan, R., 1973. *Innovations and Organizations.* Florida: Krieger Publishing Company.

271. Zhang, X., Yu, P. and Spil, T.A., 2015. Using diffusion of innovation theory to understand the factors impacting patient acceptance and usage of consumer e-health innovations: a case study in a primary care clinic. *BMC Health Services Research*, 15, pp. 71-80

272. Zhu, Q., Sarkis, J. and Kee-Hung, L., 2008. Confirmation of a measurement model for green supply chain management practices management. *International Journal of Production Economics,* 111, pp. 261-273.

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PROFILE OF THE RESEARCHER

The Researcher is an Instrumentation Engineer with a MBA in Marketing and MBA in Oil and Gas. The researcher has done Post Graduate Diploma in Project Management, Post Graduate Diploma in Procurement and Contracts Management and Post Graduate Diploma in Data Analytics. Researcher is also Six Sigma Black Belt certified in 2018. The researcher has around 13 Years of Experience in Marketing & Sales – 9 Years in Oil and Gas, 1 Year in Food Industry and 3 Years in Education Sector. The Researcher has 14 published papers in Peer Reviewed National and International Journals. The areas of Interest of the researcher are Idea Incubation, Marketing and Sales of Innovative Technologies and Innovation adoption.