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Geopolitics is Changing Interface Management Requirements for Transnational Clean Fuel Projects

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Abstract

Under the consensus future development planning through UN SDGs, renewable energy will be the fastest growing source of energy. However, the world has recently witnessed that transition to renewables cannot be fast – European Nations have suffered in winter 2021 – 2022 paying high LNG, Gas and Oil prices partly due to their un-realistic expectations from renewables and partly because of geopolitical interference to stop Nord Stream 2 Gas Pipeline Project from achieving COD. Realistically, the demand for oil and other gaseous fuels will not decline till 2040 and the businesses in oil and gas sector have been operating under strict regulatory oversight. This has made IOCs / NOCs more responsible and sensitive towards reducing environmental and social damage to the society through their operations. Under the world's quest for Cleaner Energy / Fuels Transition and an over-arching focus on reducing carbon footprint, oil and gas projects are currently more complex. Additional burden due to involvement of SDGs, increased globalization (multi-national interests) and geopolitics is making it difficult for project managers to reasonably manage the risk in Mega Projects.

The changing transnational project management requirements in energy sector call for enhanced capabilities of project managers towards agile project planning & design supported by effective interface management – enabling unrelated entities (systems, equipment, services, software and data) to successfully co-function as part of a larger project asset. Traditionally, interface management is an enabling process that defines, controls, and communicates the information needed by independent project stakeholders for fulfillment of responsibility towards successful project completion across a common boundary. Today, these requirements appear to have crossed the defined project boundries. It is shown in this study that the interface management requirements have gone beyond the traditional view and scope – social and geopolitical convergence of *"determinations of world's political leaders"* has been found as an essential interface management aspect affecting success or failure of any transnational clean fuel project – e.g., Nord Stream 2 Gas Pipeline Project.

Keywords: Geopolitics; Nord Stream; Gas Pipeline; Interface Management; Energy Transition; SDGs.

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1. Introduction

World energy demand is predicted to increase significantly over next 20 years driven by increasing prosperity in fast-growing developing economies. Despite the fact that renewable energy will be the fastest growing source of energy, demand for oil and other liquid fuels will grow for next 10 years and gradually plateau by 2040. Natural gas demand will grow robustly, supported by broad-based acceptance as cleaner energy source (compared to other hydrocarbon liquid fuels) and the increasing availability of gas, aided by the continuing expansion of liquefied natural gas (LNG). The increase in liquids production will initially be dominated by US tight oil, but OPEC production subsequently increases as US tight oil declines **[1]**. Thus, we will be seeing more oil and gas projects coming onstream in near future.

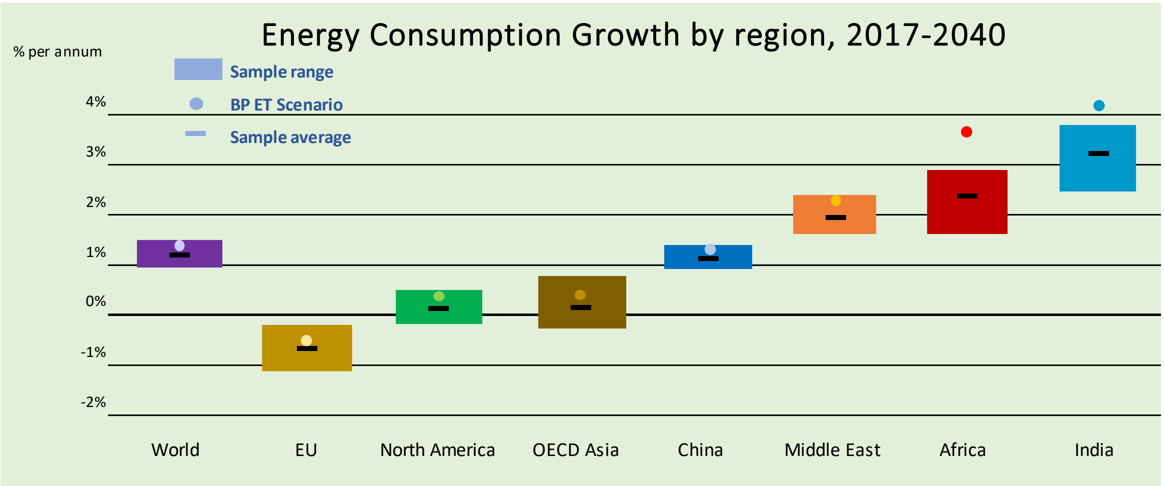

Figure 1: Energy Demand Forecast with Ongoing Cleaner Fuels Transition.

Source*: BP Energy Outlook 2019 – Energy Transition (ET) scenario developed by BP. The ET scenario is close to sample average for developed markets, but projects faster growth in developing economies.*

In the 21st century, businesses (particularly in oil and gas sector) are generally more responsible and sensitive towards reducing environmental and social damage to the society through their operations as compared to business enterprises of 20th century. Under the world's quest for transition to Cleaner Energy / Fuels and an over-arching focus on reducing carbon footprint, oil and gas mega projects are currently characterized by:

i. Increased project complexity
ii. Necessary incorporation of SDGs (Sustainable Development Goals)
iii. Increased globalization (multi-national Interests) and geopolitics
iv. Increased sharing of responsibility for Risk Control

The era of "easy hydrocarbons" is approaching its end **[2]**, and the petroleum sector players have long been planning to diversify their portfolios by tapping into emerging opportunities in unconventional oil and gas like shale gas, Oil sands, Light tight oil, Coal seam gas, LNG liquefaction, Ultra-deep water, the Arctic, offshore transport pipelines etc – all these ventures are mega-projects worth multi-billions dollar. Of significant importance among these would be transnational gas and oil pipeline projects that will cross various national boundries and operate in multiple jurisdictions. Such mega-projects call for enhanced capabilities of project managers towards agile project planning & design supported by effective interface management. Interface management is the process of enabling unrelated objects (systems, equipment, services, software and data) to successfully co-function when made part of a larger project asset. This enabling process includes defining, controlling, and communicating the information needed for fulfillment of responsibility towards successful project completion across a common boundary between several independent stakeholders. All of the project interfaces must be defined and controlled in a way that enables efficient use and change management of the systems or services procured independently – beginning at design and continuing through operations and maintenance.

This century has witnessed a number of mega-projects in oil and gas sector, which have successfully achieved COD (Commercial Operations Date) despite high CAPEX and having long lead times for reaching commercial operations. FID (Final Investment Decision) for such projects were driven by commercial deployment of technological advanced methods whereby resources were pooled by multinational Joint Ventures using their experience to implement innovative technological solutions. All these collaborative efforts were meant to minimize the high technical as well as commercial risks through sharing of responsibilities and to create a perception of overcoming geopolitical influences.

Four successfully completed oil and gas projects from Upstream (Claire Ridge Field Development), Midstream (Prelude FLNG Terminal and Pengerang RAPID) and Downstream (Trans Anatolia Pipeline) sectors have been studied for successful interface management from FID to COD.

Fifth mega-project that is discussed in this study is Nord Stream 2 Gas Pipeline project which is a transnational project similar to TANAP (Trans Anatolia Pipeline). Nord Stream 2 AG was incorporated having respective shareholding of 50%, 10%, 10%, 10%, 10% and 10% for Russian Gazprom, German Uniper (formerly E. ON), Swedish OMV, Royal Dutch Shell, German Wintershall Dea and French ENGIE. Though the Nord Stream 2 pipeline’s construction work got completed around September 2021 at a cost of USD 11 billion, however, the pipeline project is nowhere close to commissioning or commercial operations. Studying the causes of failure of Nord Stream 2 Pipeline to achieve COD will definitely give a new dimension to interface management of transnational oil and gas projects in the future world. This is important to control project risks, especially those arising out of the enhanced geopolitical influences that clash with contractual obligations between parties. Development of an interface mechanism that is capable of mitigating effects of geopolitical interferences in transnational energy projects could be the right approach for this.

2. Objectives of study

It is a basic exploratory research which highlights the problems faced by investors, financiers, small shareholders and ultimate beneficieries (consumers or end users) of transnational clean energy projects that fail to achieve COD under geopolitical influences. An effort has been made to correlate such failure with deficiency in project interface management – to find out a professional solution to a problem that is big enough to attract serious attention. Failure in achieving COD of clean energy transnational projects, under execution after careful FIDs, due to geopolitical influences or strategic interests of third parties have serious implications for project stakeholders, project beneficieries and retarding achievements under UN SDGs.

2.1. Methodology

Methodology adopted for achieving research objective constitutes collection, recording and qualitative analysis of data. The research design supports the investigation of the objective of study and formulation of hypothesis during the process of collecting, analyzing and interpreting observations.

Case studies have been presented to focus attention on "establishment of link between geopolitical interface management and project failure or success during execution". All the 5 projects discussed in this study have FID or conception time frame between 2010 – 2015. This is an effort to make observations that are coincidental yet geographically scattered and thus help to support the findings and formulation of hypothesis. The methodology used in this study is outlined below:

1. Data available in public domain is the basis of this study. Data collection is done through internet research for project publications like press releases, project webpages, project partners' webpages and other relevant resources.
2. Data compilation is done in a manner so as to facilitate comparison of project execution milestones and challenges faced therein.
3. Conclusions are drawn to identify the shortcoming of traditional view of interface management in preventing project failure which are socially (including geopolitically) sensitive.
4. Observations have been recorded for case studies which include the following:

i. Traditional Interface Management
ii. Social Interface Management
iii. Political (including geo-political and Security) Interface Management
iv. Affect on Project Success / Failure

2.2. Literature Review

It was well known during the 20th century **[3]** that most pervasive intellectual tradition to project management is systems approach – open systems that have the ability to adapt to changes in their environment and that have a hierarchy of systems and subsystems with clearly defined boundries and interfaces. Systemic view of project management got further strengthened, soon after World War II, with the set of disciplines that got developed through implementation of scientific methods in industrial and military applications – the numeric set of disciplines (e.g., control theory, operations research, systems analysis, systems engineering, etc) used to model real-life situations for accurately describing complex behaviours and to make forecast. Use of computers further provided powerful effectiveness to systems approach of management.

Interface management started in early days as a simple method of ensuring that the two subsystems have same specifications and there is no missing equipment or data. As of today, interface management is being used to define and manage complex inter-relationships of organizational, managerial and technical systems for project success. In today's world, the dynamic control needs of projects are very evident, which include importance of feedback, progressive development of information, handling of geo-political events due to their consequences adversely affecting projects' progress and necessity of changes in multilevel project controls during its execution. As a traditionally accepted norm, there are three basic types mechanisms for interface-coordinations i.e., 1) rules and standards, 2) plans and programs, and 3) personal contact **[4]**. Such mechanisms should be able to connect interfacing components or entities, seamlessly throughout the project life.

Traditional interface management of project, to fulfill the project success requirements, is generally focused on the following components:

i. Physical - Physical interaction between components
ii. Functional – Systems and sub-systems functional requirements
iii. Contractual – Suppliers and sub-contractors'interactions under Rules and Standards
iv. Organizational – Inter-diciplinary performance information exchange
v. Knowledge – Parties need regular updates of general project status
vi. Resource – Related to dependencies between suppliers of equipment, material, services and labor

It was demonstrated **[5]** that project success is a result of collaborative actions by project stakeholders throughout the project life cycle – Social Network Analysis (SNA) was found to identify network management gaps in projects, while routine gap analysis related to project management often lacks in identifying weaknesses in the organic nature of information exchange between project actors. It was also identified that most of the project governance and risk allocation are done under the project contractual arrangements (mutually agreed between stakeholders before project execution) and there is little evidence of dealing matters that fall outside the perview of those contractual arrangments – thus current application of available management tools often face limitations in providing the "Total Control of a Complex (socially and geo-politically sensitive) Project".

2.3. The New Concept of Interface Management

It is well known that oil and gas mega-projects are socially and geo-politically sensitive. According to a published article **[6]**, the changing global energy picture will continue to determine foreign policies and strategic interests of various countries depending on their status as energy producers, energy transit nations or energy consuming nations. Shifts in markets demonstrate shift in foreign policies of big players like the US. There are huge consequences of such market shifts on policies of energy deficient European countries towards their traditional energy suppliers – specifically Russia. Same is true for energy deficient and highly populated nations in Africa and Asia. More and more oil and gas mega-projects are being planned in modes that are integrative (where designer, owner and contractors have stakes in the project) and partnership-based (public owned companies and private companies are partners thereby reducing public partner's financial oulay). In this manner there is an increased distribution / sharing of project execution responsibilities as well as project risks, and increased probability of project success. However, these modes significantly complicate project's contractual framework and interface management requirements – social and political (often geo-political) interfacing requirements often put the project at greater risk (compared to a theoretical situation where such requirements are absent or not expressly defined in the project's contractual documents / relationships). Before moving on to data review and discussion, it is pertinent to state that "Force Majeure" clauses are added in contracts that administer oil and gas projects – to minimize risks of counter parties due to reasons beyond their reasonable control. However, a common observation is that treatement of force majeure clauses normally existing in such contractual frameworks state that the impact on performance of a force majeure event must be caused solely by an event listed (or similar events) under a force majeure clause and adequate documentary and other evidence in proving: (a) the force majeure event, (b) the effects of the force majeure event, (b) the steps taken in mitigating the event and (c) the costs of doing so. All such contractual clauses are subject to determination of an independent arbitrator or tribunal, thus leaving little room for expeditious redressal of aggrieved party (often an investor). Thus, an alternate solution is needed to avoid entering into arbirtration and handling such situations through social / geo-political interface management mechanisms – as a documented function of project management.

3. Presentation of data & discussion

This study covers five oil and gas megaprojects (CAPEX ranging from USD 6 billion to USD 27 billion) that have been executed by IOCs (International Oil Companies) / NOCs (National Oil Companies) recently (FID or conceptualization during 2010 – 2015 and execution during 2015 – 2021). Four out of the referred five projects successfully achieved COD and are now in their operations phase (Table-1).

Table 1: Four Mega Oil and Gas Projects Achieving Successful Commercial Operations.

Project Facts	**Upstream Project Clair Ridge**	**Midstream Project Prelude FLNG**	**Downstream Project Trans-Anatolia**	**Midstream Project Pengerang RAPID**
Planned	Planned for development of Claire field discovery in UK Continental Shelf	Planned for development of Prelude and Concerto fields North East of Australia for LNG deliveries	Planned for development of Shah Deniz gas field in Caspian Sea for European Gas deliveries through pipeline	Planned to refine Saudi Aramco Crude in Malaysia for Asia Pacific Buyers of Euro Compliant Petroleum Products
FID	October 2011	May 2011	December 2013	April 2014
Construction	7 years starting 2011	7 years starting 2012	4 years starting 2015	5 years starting 2014
COD	November 2018 2-Years Delay from 2016 for Technical Reasons	November 2018 Delayed to 2019 due to Technical Problems	June 2019 On time completion with project costs less than budgeted	June 2019 Refinery started operations
Project CAPEX	$ 6 billion	$ 10 billion	$ 7 billion	$ 27 billion
Project Partners	• BP 45.1% • Shell 28% • Chevron 19.4% • ConocoPhillips 7.5%	• Shell 67.5% • INPEX 17.5% • CPC 5% • KOGAS 10%	• SGC 51% • BOTAŞ 30% • BP 12% • SOCAR Turkey 7%	• Saudi Aramco 50% • Petronas 50%

The fifth project that is the focus of this study is Nord Stream 2 pipeline project for construction of 1230 km x 2 x 1230 mm (diameter) natural gas pipelines. The twin pipeline project through the Baltic Sea was conceived to fulfill additional Russian natural gas (from Bovanenkovo gas field with proven reserves of 4.9 trillion cubic meters in Yamal peninsula) transportation requirements to Germany – it is important to note that existing Nord Stream twen pipelines (having capacity 55 BCMA) have been operational since 2011 / 2012, successfully delivering Russian natural gas to Germany. The Nord Stream 2 AG was incorporated in Switzerland in 2015 having respective shareholding of 50%, 10%, 10%, 10%, 10% and 10% by Russian Gazprom, German Uniper (formerly E. ON), Swedish OMV, Royal Dutch Shell, German Wintershall Dea and French ENGIE **[7]**. Nord Stream 2 pipeline construction costs are currently estimated to be USD 11 billion as compared to original budget of USD 9 billion – overall responsibility for successful project completion lies with Russian Gazprom being the project leader with 51% equity.

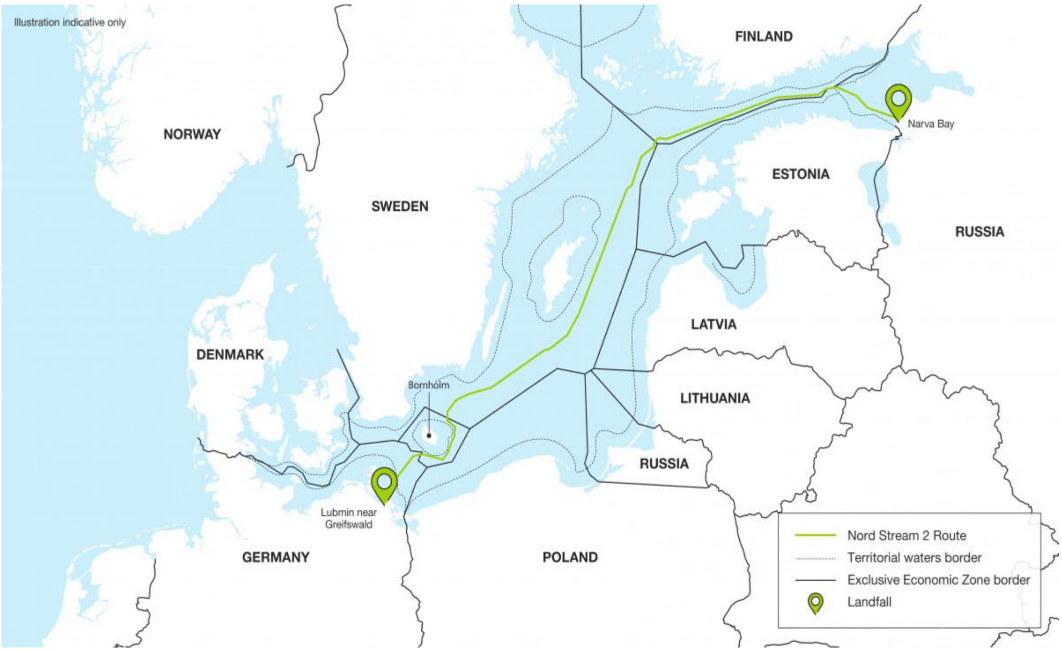

Figure 2: Schematic of Nord Stream 2 Pipeline - Source: Clean Energy Wire.

In perspective, Nord Stream AG was incorporated in Switzerland in 2005 as consortium of Russian Gazprom (51% shareholding), German Wintershall Dea AG (15.5% shareholding), German PEGI / E.ON (15.5% shareholding), Dutch N.V. Nederlandse Gasunie (9% shareholding) and French ENGIE (9% shareholding). In 2012, Nord Stream AG initiated feasibility and route studies for project expansion by adding two additional lines to double the carrying capacity of Nord Stream pipelines to 110 BCMA., Nord Stream 2 AG signed the agreements for the Nord Stream 2 gas pipeline project with ENGIE, OMV, Royal Dutch Shell, Uniper, and Wintershall in April 2017 for financing of 50% of the total cost of the project. **[8], [9]**

3.1. Distinct Treatment of Western Leaders for Nord Stream 2 Project

At the time of start of construction of Nord Stream 2 pipeline in May 2018, gas supplies from Russia to Europe were facing difficutlies due to EU sanctions on Russia, following its annexation of Crimea. In January 2019, the

US ambassador in Germany, Richard Grenell, sent letters to companies involved in the construction of Nord Stream 2 urging them to stop working on the project and threatening them with the possibility of sanctions. The pipeline was originally scheduled for completion by the end of 2019. About 2,300 km out of approximately 2,460 km had been laid by December 2019, when Swiss pipelaying company Allseas suspended activity following the introduction of U.S. sanctions legislation – due to threats from US Republican Senators Ted Cruz and Ron Johnson. On April 4, 2019 European Parliament approved Amending Directive 2009/73/EC (concerning common rules for the internal market in natural gas) whereby the Gas Directive in its entirety (as well as the related legal acts like the Gas Regulation, network codes and guidelines, unless otherwise provided in those acts) became applicable to pipelines to and from third countries, including existing and future pipelines, up to the border of EU jurisdiction **[10]**. Nord Strea 2 AG took it as a breach of ECT (Energy Charter Treaty) and raised the issue with the President of European Union that this will make the project subject to regulatory determination for any required "exceptions" – which was against the original understanding.

Table 2: Facts Regarding Nord Stream 2 Pipeline Project.

Project Facts	**Downstream Project Nord Stream 2 Pipeline**
Planned	Planned for carrying additional Russian Gas supplies through Baltic Sea to Germany (along the route of existing Nordstream pipeline) by-passing Ukraine
FID	April 2017
Construction	4 years starting 2018
COD	Planned for December 2019, Delayed and recently put "On Hold" due to German Executive Order Pipeline Mechanically Completed in September 2021
Project CAPEX	$ 11 billion ($ 2 billion over-budget)
Project Partners	• Russian Gazprom 50% • German Uniper 10% • Swedish OMV 10% • Shell 10% • German Wintershall Dea 10% • French Engie 10%

In May 2020, the German energy regulator refused an exception from competition rules that require Nord Stream 2 to separate gas ownership from transmission. In August 2020, Poland fined Gazprom €50 million due to the latter's lack of cooperation with an investigation launched by UOKiK, the Polish anti-monopoly watchdog. UOKiK cited competition rules against Gazprom and companies that are financing the project, suspecting that they have continued to work on the pipeline without permission from the government of Poland. Former US President Donald Trump, on his final full day in office on 19th January 2021, the U.S. had introduced first sanctions on the Russian ship Fortuna. However, the Russian pipelaying ship Akademik Cherskiy continued pipe-laying. In January, Fortuna, another pipe-layer joined forces with the Akademik Cherskiy to complete the pipeline. On 4 June 2021, President Putin announced that the pipe-laying for first line of the Nord Stream 2 has been fully completed. On 10 June 2021, the sections of the pipeline were connected. The laying of the second line was completed in September 2021. In June 2021, U.S. Secretary of State Antony Blinken said that Nord Stream 2 completion was inevitable. In July 2021, the U.S. urged Ukraine not to criticise a forthcoming agreement with Germany over the pipeline. On 20 July 2021, Joe Biden and Angela Merkel reached a conclusive deal that the U.S. may trigger sanctions if Russia uses Nord Stream as a "political weapon". The deal aims to prevent Poland and Ukraine from being cut off from Russian gas supplies. The contract for transiting Russian gas through Ukraine will be prolonged until 2034, if the Russian government agrees. On 16 November 2021, Germany's energy regulator suspended approval of the Nord Stream 2. On 9 December 2021, Polish Prime Minister Mateusz Morawiecki called on Germany's newly appointed Chancellor Olaf Scholz to oppose the start-up of Nord Stream 2 and not to give in to pressure from Russia. German Chancellor Olaf Scholz suspended certification of Nord Stream 2 on 22 February 2022 in consequence of Russia's recognition of the Donetsk and Luhansk republics and the deployment of troops in territory held by the DPR and LPR.

3.2. Competition of Nord Stream 2 Project with Southern Gas Corridor

Southern Gas Corridor (SGC) was termed as the highest energy security priority by European Commission in 2008 with the objective: "Ensuring secure and affordable supplies of energy to Europeans by diversifying supply routes that decrease the dependence of EU countries on a single supplier (Russia) of ntural gas and other energy resources". Major chunk of the Russian gas comes to Europe via Ukraine and hostilities between Russia and Ukraine often caused major fluctuations of volumes transiting through Ukraine. SGC was a USD 42 billion project transiting six nations but effecting more than 50 countries who have direct or direct involvement / interests associated with its construction and operations. SGC comprised three separate projects **[11, 12]**:

A. Southern Caucasus Pipeline Expansion (a 690 km pipeline laid parallel to SCP from Shah Deniz field Sangachal gas terminal in Azebaijan to Turkish border through Georgia).
B. TANAP, constituting 54 percent of the total length of SGC, lies entirely in Turkey – starting from eastern border with Georgia and terminating at western border with Greece.
C. 878 km long Trans Adriatic Pipeline (TAP) is the final segment of SGC contributing 26% to its length. Starting from TANAP at Turkish border, this pipeline travels northern Greece into Albania, then crosses Adriatic Sea to end in Italy.

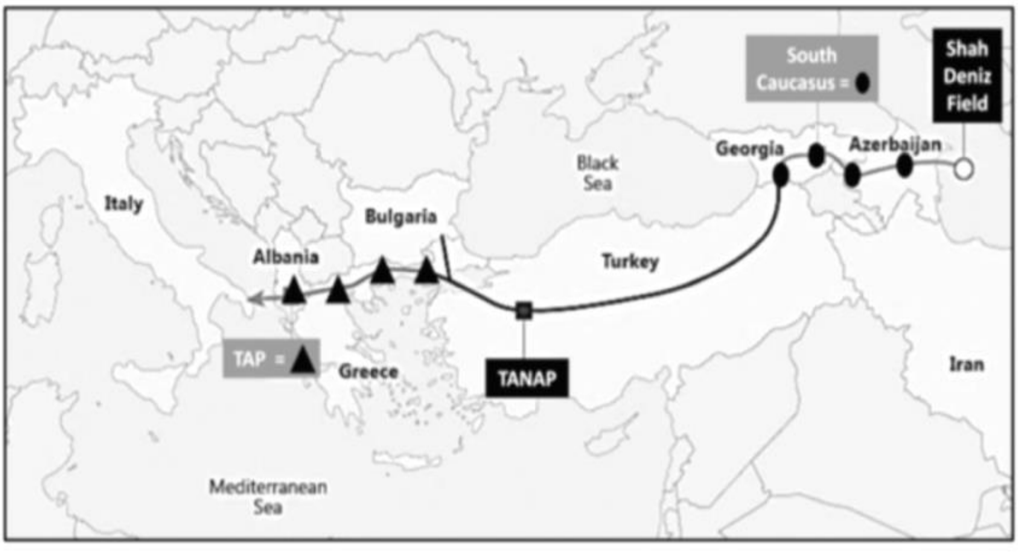

Figure 3: Southern Gas Corridor (SGC) Route.

3.3. US Shale Developments Increased LNG Supplies to Europe

US Shale developments have changed the US status from an energy importing country to largest Oil (and major LNG) exporting country in the world.

US has all the more interest to sell its abundant LNG to rich Western European nations. Since majority of European gas imports come from Russia, there is a direct economic conflict between Russia and US for energy supplies to Europe.

US has always supported Europe in reducing its dependence on Russian gas.

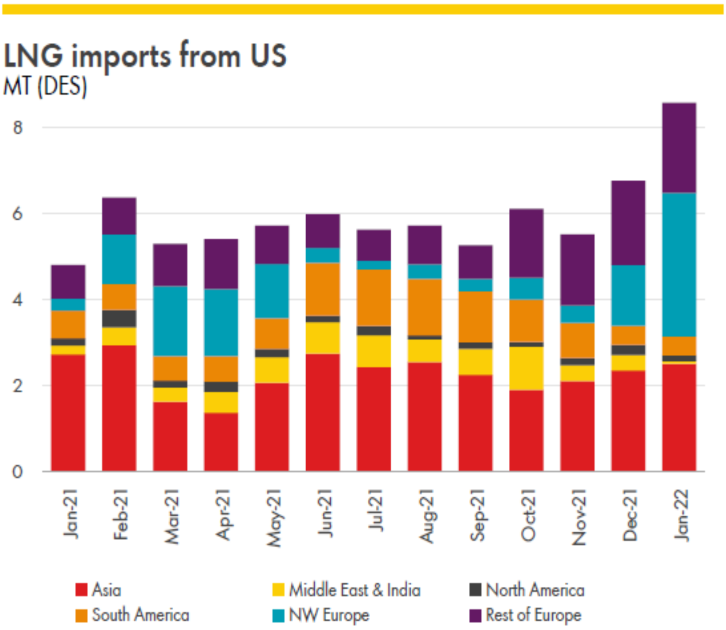

Figure 4: Recent Increase in US LNG Supplies to North West Europe, Source: Shell LNG Outlook 2022 **[**13].

3.4. Interface Management of the Projects Under Discussion

Data related to interface management requirements for the five projects under discussion is provided in Tables: 3 – 7.

3.4.1.Clair ridge upstream project

Two years project delay was mainly because of deployment of special LoSal® enhanced oil recovery technology to achieve production in harsh UKCS environment **[14,15,16].**

Table 3: Interface Management Requirements for Clair Ridge Project.

CLAIR RIDGE UPSTREAM PROJECT		
INTERFACE MANGAGEMENT TYPE		PROJECT PERFORMANCE
Traditional	Physical	• 2 bridge-linked offshore platforms • 5.5-km x 22-inch oil export pipeline connecting the Clair Phase 1 export pipeline to Shetland • 14.6-km x 6-inch gas export pipeline connecting Clair Ridge into the WOSPS (transporting gas from West of Shetland to the Sullom Voe Terminal) • An advanced drill rig for drilling program (total 36 wells) over 10 years.
	Functional	• Designed to withstand the harshest conditions in the UKCS • Deployment of BP's LoSal® enhanced oil recovery technology and Digital Twin model • Clair Ridge facilities were designed for 40 years of production • Estimated 640 million bbl of oil with plateau production level of 120,000 bpd • The Clair Ridge project dominated UKCS reserve adds and production volumes
	Contractual	Owners, partners, suppliers and sub-contractors' interactions under international law, regulatory rules and international standards
	Organizational	LRQA acted as Notified Body for delivering Pressure Equipment Directive (PED) services and as Independent Verification Body providing design, procurement, construction, installation, hook up, test and commissioning services to the Clair Ridge platforms and subsea pipelines (including design, procurement, construction, hook up and commissioning services for modifications to the Clair Phase I platform)
	Resource	Major EPC Contractors and Suppliers: ✓ Amec Foster Wheeler ✓ Aker Solutions (formerly Kvaerner) ✓ KCAD ✓ Hyundai Heavy Industries (HHI) ✓ Subsea 7 ✓ PSN
New Requirement	Social and Geo-Political	UK based British Petroleum is the operator of the project. All project partners were IOCs with the distinction of having origins in US and EU.

3.4.2.Prelude flng liquefaction terminal

One-year delay in project completion mainly due to technical reasons.

There are still problems in operational phase, being the first of its kind project with technical challenges not faced in the history **[17,18,19].**

Table 4: Interface Management Requirements for Prelude FLNG Project.

PRELUDE FLNG PROJECT		
INTERFACE MANGAGEMENT TYPE		PROJECT PERFORMANCE
Traditional	Physical	• Prelude FLNG facility is 488-meter-long and 74-meter-wide • 7 wells, 4 flowlines, 6 umbilicals and 14 flexible risers • 6 LNG storage tanks with a total capacity of 220,000m³
	Functional	• First and the largest floating LNG production facility • Designed to extract LNG from remote offshore field whose reserves didn't justify land-based production • LNG liquefaction capacity of 3.6 mtpa alongwith 1.7 mtpa production of NGLs • Designed for safe LNG off-loading during relative movement of ship and platform during rough sea conditions
	Contractual	Owners, partners, suppliers and sub-contractors' interactions under international law, regulatory rules and international standards
	Organizational	Applus+ inspection services were engaged to evaluate compliance of products, processes and services comply with relevant standards (regulatory as well as voluntary) – guaranteeing fulfillment of contractual obligations in achievement of project objectives
	Resource	Major EPC Contractors and Suppliers: ✓ Technip Australia ✓ JGC Holdings Corporation (Japan) ✓ Samsung (South Korea) ✓ FMC Technologies Australia ✓ DOF Subsea Australia
New Requirement	Social and Geo-Political	Royal Dutch Shell is the operator of the project. Project partners include IOCs and Taiwanese / South Korean companies with the distinction of having origins / affiliations in US and EU.

3.4.3.Tanap gas pipeline construction

The project was completed on time and at less price than originally budgeted **[12,20,21,22,23,24].**

Table 5: Interface Management Requirements for TANAP Project.

TRANS ANATOLIA PIPELINE PROJECT		
INTERFACE MANGAGEMENT TYPE		PROJECT PERFORMANCE
Traditional	Physical	• A combination of 56-inch and 48-inch dia pipeline • 2 compressor stations for intermittent pressure boosting • 4 x metering stations plus 11 x pigging stations for smooth gas off-takes and operations • Design life of 40 years with provision of progressive capacity enhancement and expansion
	Functional	• Designed to carry Central Asian – Caspian Sea gases to Europe • Providing for diversification of gas sources supplying to Europe • Project was a part of greater framework of projects under SGC initiative – fulfilling strategic energy requirements of EU
	Contractual	Owners, partners, suppliers and sub-contractors' interactions under international law, regulatory rules and international standards
	Organizational	• World Bank arranged Consulting Services for Studies, Design, Engineering, Procurement, Construction management, Supervision, and Monitoring of TANAP (World Bank Doucment, P157416 Seq: 05) • Intertek and Ugetam provided quality assurance, technical inspection and pipe testing services to ensure commitment to quality and integrity of the line pipe for ensuring the safe operation of the pipeline as well as minimizing flow or contamination risks
	Resource	Major EPC Contractors and Suppliers: ✓ Worley Parsons ✓ ILF Consulting Engineers ✓ Turkish Fernas Construction ✓ Consortium of Sicim, Yuksel, and Akkord ✓ Turkish Tefken Construction and Installation Company ✓ Joint-venture between Punj Lloyd and Limak ✓ ABB Elektrik Sanayi
New Requirement	Social and Geo-Political	• Azerbaijan based SOCAR is the operator of the project. Other project partners are IOCs with the distinction of having origins in US and EU. • Shah Deniz gas field, is operated by BP on behalf of its partners under an unincorporated Joint Venture (JV) shareholding by BP 28.8%, TPAO 19%, SOCAR 16.7%, Petronas 15.5%, LUKoil 10% and NIOC 10%

3.4.4.Pengerang petroleum refinery installation

Refinery part of the project completed on time, while the petrochemical plant part of RAPID (Refinery And

Petrochemical Integrated Development) project is still ongoing – delayed due to COVID 19 restrictions **[25,26,27].**

Table 6: Interface Management Requirements for Pengerang RAPID Project.

PENGERANG RAPID PROJECT		
INTERFACE MANGAGEMENT TYPE		PROJECT PERFORMANCE
Traditional	Physical	• State of the art refinery for producing Euro compliant petroleum products • Integrated Cracker and Petrochemical Plant • Dedicated harbour with provision to accommodate VLCC and ULCC • Associated facilities like air separation unit, raw water supply, cogeneration plant, regasification terminal, deepwater terminal and utilities.
	Functional	• Designed to supply state-of-the-art 300,000 bpd Euro compliant fuels to Asia Pacific market • Production of petrochemicals • Supply of naphtha-LPG feedstock for its 3.3 mtpa integrated cracker
	Contractual	Owners, partners, suppliers and sub-contractors' interactions under international law, regulatory rules and international standards
	Organizational	Punj Lloyd was appointed for Project Management, Design, Engineering, Interface with other Contractors and third parties, Procurement, Construction, Inspection and Testing, Pre-Commissioning and Commissioning
	Resource	Major Contractors and Suppliers: ✓ Axens ✓ Technip ✓ Jacobs ✓ Sinopec Engineering ✓ Tecnicas Reunidas ✓ Petrofac International (UAE) LLC and Petrofac E&C Sdn. Bhd. ✓ Toyo Engineering Corp. and Toyo Engineering & Construction Sdn. Bhd.
New Requirement	Social and Geo-Political	PRefChem (a Joint Venture of PETRONAS and ARAMCO) is the operator of the project. Project partners are among world's largest NOCs with the distinction of having origins in Asia.

3.4.5.Nord stream 2 pipeline project

Construction of Nord Stream 2 pipeline got delayed for 2 years, not because of any technical reasons.

The main reason for delays were disruptions caused in issuance of necessary approvals in various EU jurisdictions and a continuing threat by US government related to imposition of sanctions on companies involved in Nord Stream 2 project. (refer Section 3.1)

Table 7: Interface Management Requirements for Nord Stream 2 Project.

<table>
<tr><td colspan="3">NORD STREAM 2 PIPELIEN PROJECT</td></tr>
<tr><td colspan="2">INTERFACE MANGAGEMENT TYPE</td><td>PROJECT PERFORMANCE</td></tr>
<tr><td rowspan="6">Traditional</td><td>Physical</td><td>• 2 x 1230 km subsea pipelines
• Land pipelines at start and end points
• Valve assemblies and metering stations</td></tr>
<tr><td>Functional</td><td>• Designed to transport Russian gas to Germany via Baltic Sea
• High pressure pipeline with no intermediate compression requirements</td></tr>
<tr><td>Contractual</td><td>Owners, partners, suppliers and sub-contractors’ interactions under international law, regulatory rules and international standards</td></tr>
<tr><td>Organizational</td><td>Norway based DNV GL was engaged to verify the safety and technical integrity of the Nord Stream 2 pipeline system, and to issue a certificate of compliance upon the "satisfactory completion" of the project in accordance with its independent technical Standard DNVGL-OS-F101. However, DNV GL ceased its operations in January 2021 due to US Sanctions.</td></tr>
<tr><td>Resource</td><td>Major EPC Contractors and Suppliers:
✓ Bilfinger Engineering & Technologies
✓ Delta Energy Services (Norway)
✓ Aker Solutions (formerly Kvaerner)
✓ Allseas
✓ Europipe GmbH
✓ Russian OMK
✓ Russian Chelpipe</td></tr>
<tr><td>Social and Geo-Political</td><td>Nord Stream 2 is incorporated in Switzerland but major Operational Responsibilities lie with Russian Gazprom (50% equity stake). Other partners include IOCs with the distinction of having origins in EU.</td></tr>
</table>

4. Analysis & conclusion

Review and analysis are carried out related to various interface management mechanisms for the five referred projects, as provided in following paragraphs.

4.1. Physical Interface Management

With regards to physical interface management, Clair ridge and Prelude FLNG were the most technically challenging involving offshore installations, while the least technically challenging was TANAP. Nord Stream 2 posed medium level technical challenges which were easily overcome to achieve mechanical completion by utilizing available precedent in the form of existing Nord Stream pipeline.

4.2. Functional Interface Management

With regards to functional interface management, Prelude FLNG and Pengerang RAPID were the most technically challenging involving offshore installations and extensive process engineering, while the least functionally challenging was TANAP – transportation of gas through onshore pipeline. Nord Stream 2 posed medium level functional challenges due to subsea laying of pipeline. However, these could be easily overcome to achieve COD by utilizing available precedent in the form of existing Nord Stream pipeline. Unfortunately, that remained a dream due to other issues.

4.3. Contractual Interface Management

With regards to contractual interface management, there were no serious issues about Clair ridge, TANAP, Pengeran RAPID and Prelude FLNG as they complete successfully. However, with regards to Nord Stream pipeline project, there were serious challenges related to EPC contractors' performance under an environment of US Sanctions and delays in regulatory approvals under various EU jurisdictions. Although, Nord Stream 2 was mechanically complete in September 2021, the environment of economic sanctions and withdrawal of approval by German Regulator made it impossible for the project team to achieve COD.

4.4. Organizational Interface Management

With regards to organizational interface management, TANAP was the best managed project as it enjoyed EU commitment as well as special funding and organizational support from World Bank. TANAP project was part of SGC initiative by EU, to transport gas from Shah Deniz gas field which has an equity stake by Iranian NIOC which is a state-run organization (under US sanctions). While supporting this project, World Bank and EU deliberately kept a blind eye towards the fact that the gas sales from Shah Deniz field will benefit Iranian oil company and Iranian government. Nord Stream 2 faced serious organizational challenges from contractors, regulators, Thrid Party Inspectors, EU Council as well as some Western governments.

4.5. Resource Interface Management

With regards to resource interface management, it may be noted that all the five projects were executed by internationally renowned companies which were engaged through competitive bidding process. However, Nord Stream 2 faced serious resource mobilization challenges due to fact that the pipeline route passes through various national jurisdictions, which were hostile towards the project and each one of them tried to hinder project progress. Significant delay and cost over-run resulted.

4.6. Social and Geo-Political Interface Management

With regards to social and geo-political interface management, Nord Stream 2 pipeline project has clearly distinct standing when compared to other four projects. Clair ridge, Prelude FLNG and Pengerang RAPID were least affected by geo-politics or social systems because of reasons that include: 1) each project site lies in one national jurisdiction, 2) none of the projects had a rival politically motivated project, 3) All the projects have partners that are politically supported by West including US. As regards TANAP, being a part of SGC, the project got extra-ordinary political support not only from EU, but also from US and international funding organizations like World Bank. Nord Stream 2 pipeline project was a Russian sponsored project. The project did receive political support from Germany (part of EU) but that was not sufficient to overcome the geo-political issues posed by other members of EU and the US. The EU Council opposed the Nord Stream 2 project to the extent that rules were amended to convince German regulating authority to retract approval of the project, which resulted in stoppage of work on the project commissioning despite the fact that mechanical completion was achieved through a significant CAPEX of over USD 14 billion.

4.7. Conclusion

The management of Nord Stream 2 pipeline project, despite applying tremendous efforts in successful contractual interface management, organizational interface management and resource interface management, failed to achieve commercial operations of the project due to following reasons:

1. There was a global social environment which did not favour Nord Stream 2 project completion
2. There were geo-political challenges which could not be over come or handled appropriately
3. Nord Stream 2 project faced organizational, contractual and resource constraints and issues which were a direct consequence of bad or less than optimum social / geo-political interface management.

It is interestingly observed that all the executive orders issued by US government and the regulatory amendments issued by EU parliament or individual jurisdication EU regulators, were issued as generalized orders (without specific mention of Nord Stream 2 Pipeline Project), making the situation even more complex to handle for the project managers. Such observations indicate necessity for involvement of stake holders beyond the general hierarchy of the project team – for development of mechanisms for social / geo-political interface management.

In conclusion, a hypothesis is generated which constitutes relevant variables and basic elements of key issue at hand. The forming up of the premise is expected to help detailed research related to development of a project interface mechanism with following characteristics:

A. Capable of minimizing impact of geopolitics through discretionary legislation by Sovereigns and Geopolitical Blocks
B. FID and Construction contracts should be executed with appropriate mechanisms (safeguarding investors and project beneficieries) in place to handle situations described at “A” above.
C. Possible international legislation to be in place to protect projects facing situation described at “A” above.
D. Expeditious intervention by ICJ for rescue of projects facing situation described at “A” above.

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