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**NEXT GENERATION
INFRASTRUCTURE**

**A CONCEPTUAL FRAMEWORK FOR HYBRID
EVALUATION OF LONG-TERM ENERGY
INFRASTRUCTURE SYSTEMS: AN EMPIRICAL
STUDY OF CRITICAL OIL AND GAS
INFRASTRUCTURES**

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Introduction

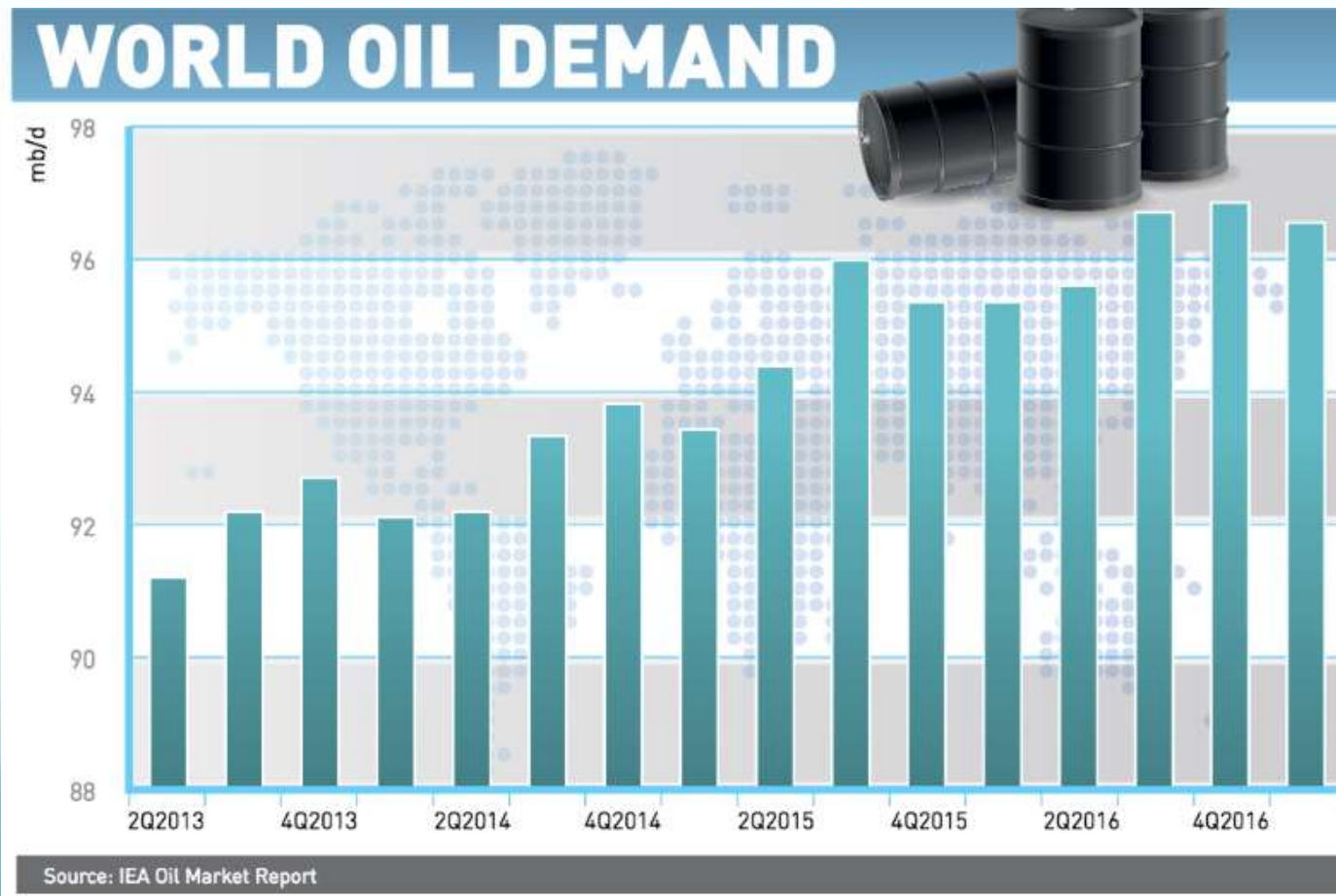
- Develop conceptual framework for decision support tool kit for assessing sustainability and resilience of downstream critical oil and gas infrastructure systems (DCOGI).
- Indicator system – applicable to all its life stages of DCOGI.



Is all oil and gas fashionable into the future



- In 2016 global oil consumption reached 1.4MLN BPD (IEA Oil Market Report).
- Current forecast suggest global consumption to reach 1.5MLN BPD (IEA Oil Market Report).
- Gas increased role in economic growth and national security – Particularly generation of electricity.





Problems





Problems

- Impact of vandalism and politically motivated interdictions. E.g. NNPC reported loss of N57.71b due 3232 vandalised pipeline points in 14months from Jan. 2015 (Tubotein report, 2016).
- Reports of impact on supply to customers, and possibility of shorting down the refineries.
- Social unrest e.g. the Dakota pipeline project – impeded by protesters – was to create 12000jobs, and transport 470,000BPD (EPA report, 2017).
- Environmental degradation e.g. Dilbit incident in July 2010 – spilled 1.2m gallons of oil into Kalamazoo river, cost \$765m to clean up(EPA report, 2017) .



Motivations

- Energy Security – Continuous availability of products is pivotal.
- Societal/social wellbeing – soft and hard infrastructures rely on oil and gas.
- Sustained Economic Growth – e.g. UAE, Qatar, Nigeria, Saudi Arabia, Libya, Russia, India etc.



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Next Generation Critical oil and gas distribution Infrastructures



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- Holistic not fragmented assessment framework - A sustainable DCOGI system has to be resilient.
- Broad array of Stakeholders involved
- Global – Across the globe e.g. developed and developing countries.



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Approach

Debate in literature - Assessing sustainability and resilience. We proposed a hybrid approach.

Figure 3: Hybrid Model



Approach

Hybrid considerations



Figure 4: Sustainability Considerations & Resilience Component



Approach

- Impact characterization
- Industry Focus Groups - oil and gas industry practitioners
- Interviews
- Questionnaires
- Comprehensive Literature review
- Adapt sustainability frameworks e.g. ARUP SPeAR

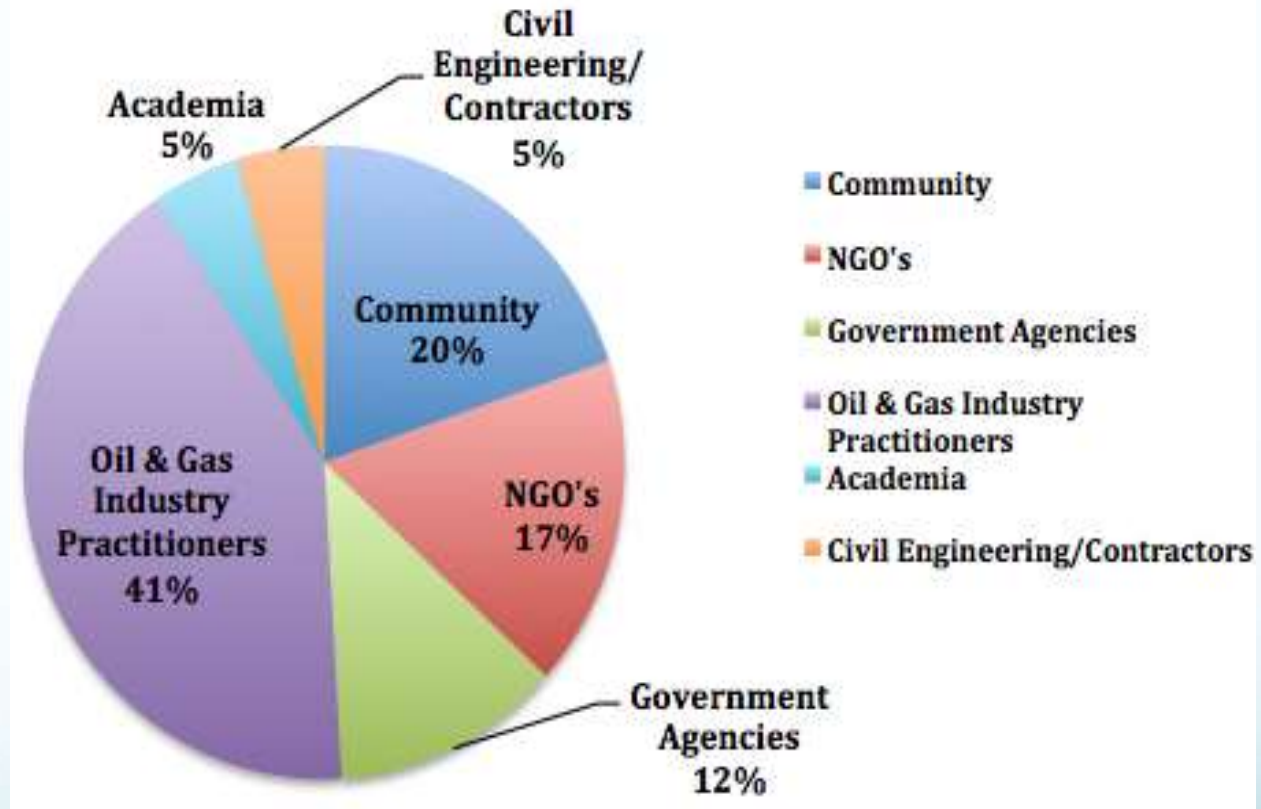


Figure 5: Categories of Survey Respondents



Findings

- Lack of adequate security for infrastructures
- Obsolete / Ageing facilities
- Industrial unrest
- Lack of public awareness (infrastructure as a national property for all of us)
- Non adherence to guidelines by infrastructure owners
- Vandalism / deliberate attacks
- Proper stakeholders / community relations management
- Legislation
- Use of trackers
- Real time monitoring
- Natural disasters / accidents
- Lack of forward looking assessment tools
- Adapting to changing climate
- Resettlement and relocation management
- Site security plans / safe buffer zones around facilities.
- Accessibility – road / rail infrastructure
- Sincerity of purpose by all stakeholders / divide and rule approach
- People – vision – politics



Findings

No shared understanding of the meaning of sustainability and resilience in the context of DCOGI systems - The Longevity/Flexibility of DCOGIs Physical Structure, Uninterrupted Delivery of Oil or Gas products, Adequate Organizational/Management system, Economic Competitiveness of DCOGIs.



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Conceptual framework



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Conclusion

- As part of broader research – development of criteria for sub-indicators.
- The development of decision support tool for sustainability and resilience assessment of DCOGIs – applicable to both developed and developing countries.
- Applicable for rehabilitation of existing DCOGIs and future DCOGIs developments



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Thank You

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