Analysis of risk management practices of the oil and gas industry in Southeast Texas during Hurricane Harvey

Gevorg Sargsyan, James Slaydon, Enrique (Henry) Venta, Ricardo Colon, Paul Latiolais[1]

Abstract

The rapid recovery of the oil and gas sector from natural disasters such as Hurricane Harvey is important for the local economic development of Southeast Texas. The recovery of this industry depends on efficient risk management from natural disasters. In this study Participatory Analysis of Risk Management (PARM) methodology is developed to determine the best risk management practices of recovery and resiliency from natural disasters. The other aim of this tool is to diagnose challenges and use past experiences of local stakeholders to avoid big losses in the future. This comprehensive analysis tool will help to analyze how oil and gas companies do risk identification, assessment, response and monitoring after natural disasters, to reach reliable conclusions and recommendations. This study describes in detail the PARM methodology and applies it to the oil and gas sector in Southeast Texas.

1. Introduction and background

In regions where natural disasters are frequent, there is a need to analyze risk management practices that support local economic growth by improving risk management strategies and/or by reusing best practices of the past. “We need to know, very simply, what works and why. Then we need to apply it.” (Porter, 1990) This kind of analysis is especially important when a sectorTJE/F2 12rlu.00000.0

Companies were unable to transport shipments of products to their customers. Refineries and chemical plants were unable to receive shipments of raw materials due to disruption of transportation by truck, railway, and barge (Cassiday, 2018). These factors highlight the importance of risk management in the oil and gas sector.

The purpose of this study was to observe and analyze best practices of risk management that oil and gas sector companies used in Southeast Texas to be resilient and recover from Hurricane Harvey. In order to achieve the research goal, we adopted a well known local economic development analysis model Participatory Appraisal of Competitive Advantage (PACA) designed by Brazilian and German researchers (Meyer-Stamer, 2006).

2. Research method

As mentioned above in areas where natural disasters are frequent, there is a need to design and implement participatory local economic recovery plans. “Successful local economic development is based on collective action and involves a partnership between the public and private sector.” (Meyer-Stamer, 2006) We believe that successful risk management, recovery, and resiliency of the oil and gas industry in Southeast Texas also requires collective action. “Successful initiatives have a common characteristic: shared understanding.” (Porter, 2000) Moreover, the recovery of the oil and gas industry from natural disasters like Hurricane Harvey should always begin with planning to efficiently manage risks in the future. This argument is similar to the classic approach of local economic development by Blakely and Bradshaw (Blakely and Bradshaw, 2002). According to World Bank “local economic development should always begin with the formulation of a strategy.” There is also evidence that a top-down (governmental) approach is efficient only in large development projects and investments (i.e. development of infrastructure: roads, railroads, airports, etc.). “Active government participation in a privately led effort, rather than an initiative controlled by the government, will have a better chance of success.” (Porter, 2000) Risk management is challenging because of its efficient implementation in the local economy depends on the involvement/engagement of different stakeholders, and it requires continuous communication and coordination of risk management actions and recovery efforts.

The Participatory Analysis of Risk Management (PARM) methodology used in this study is based on the Participatory Appraisal of Competitive Advantage (PACA). PACA method emerged from the cooperation between the Chamber of Industry and Commerce, Brazil and the Chamber of Arts and Crafts, Germany. (Meyer-Stamer, 2006) The PACA model uses the theory of location competition and economic development by well-known researcher and Harward Business School professor Michael Porter. (Porter, 1990) The methodology uses Porter’s diamond and Porter’s five forces and value chain analysis to capture the structure of each sector of the local economy and helps to facilitate the entire research. (Meyer-Stamer, 2004) PACA methodology has been successfully used in more than twenty countries by researchers, universities, international organizations, local governments, and others.

For this study, we adapted the PACA logic to design the Participatory Analysis of Risk Management (PARM) methodology. The PARM method helps to identify the best risk management practices of recovery and resiliency from natural disasters. The other aim of this tool is to diagnose challenges and risks that local stakeholders experienced during previous disasters to help mitigate losses during the next events. The model also helps with reaching reliable conclusions and recommendations. Another purpose of PARM methodology is to stimulate learning among local stakeholders and establish a shared vision of local economic growth and common strategy to overcome risks and challenges from natural disasters. The three components in Chart 1 are the core elements of the methodology.

Figure 1. Three core elements of PARM methodology

1st component. The **participatory** approach involves local stakeholders who have knowledge and experiences from the recovery of the previous natural disasters.

2nd component. Risk management **analysis** is a careful study of best managerial practices of risks, recovery efforts, and resiliency.

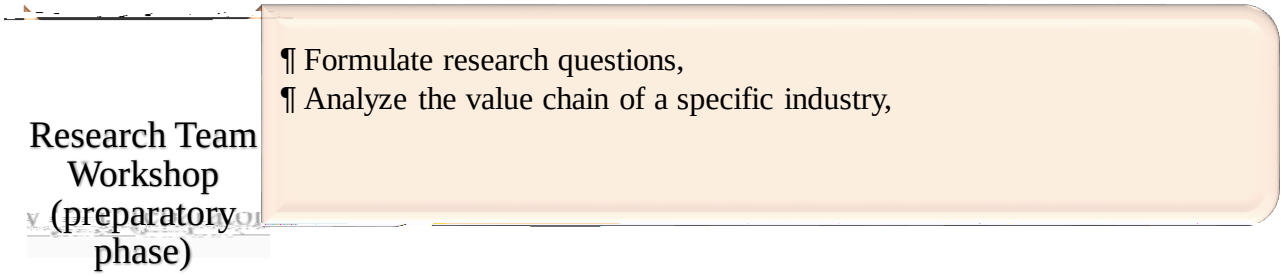
3rd component. The study focuses on the analysis of **risk management:** eliminate or reduce risk through risk identification, risk assessment, risk response, and risk monitoring. The analysis includes risk acceptance, risk mitigation, risk transfer, risk financing, and risk avoidance.

The five steps that are the principal phases of PARM are shown in figure 2.

Future use of PARM methodology

PARM is appropriate for areas where a natural disaster has happened recently and there is a need to analyze the situation and plan local economic growth. Its participatory approach can help to find solutions. The most important advantage is that this tool helps to formulate appropriate projects to recover from natural disasters more quickly.

Figure 2. PARM methodology's workflow chart



3.

4. Discussion of results

Participatory analysis of risk management in the oil and gas industry helps to fully understand how prepared are the companies in this industry, how quickly they recovered from hurricanes and also to what extent it impacted their human resource management. This study summarizes the risks and best risk management practices related to plant shutdown, plant restart, and HR management during those two stages. Researchers met with representatives from industry in Southeast Texas to discuss resiliency and recovery in the aftermath of Harvey.

In terms of resiliency, industry representatives informed that sensitive equipment has been raised at facilities to avoid flooding. Also, facilities have improved water drainage systems and undertaken flood mitigation projects. Rapid access to power generators has been secured with contractors. Emergency response plans have been updated with policies and procedures that reflect lessons learned from Harvey. Weather stations have been placed in service or will be acquired to obtain real-time and more accurate weather data, particularly with respect to rainfall. Another major finding is that flood gauges across Southeast Texas, which currently require manual readings of gauge height, should be modernized to collect data using sensors that can transmit flood data by radio or satellite. This is particularly important with respect to the flood gauges located upstream in the Neches River. Industry representatives commented that the high cost of satellite telephones and service plans are not an efficient use of financial resources, especially since these telephones remain idle for most of the year. Accessibility to rental satellite phones by providing more affordable service plans is highly recommended.

With respect to recovery, high water vehicles will be acquired to facilitate quick response in flooded areas. Air drones have been acquired to assess the damage and flooding. A significant finding is that current federal regulations by the Federal Aviation Administration (FAA) should facilitate the use of drones in response to an emergency. Another significant finding with respect to regulations is that labor standards regarding industry-based certifications should be revised as current labor standards may cause labor shortages following an emergency. Logistics is an area where improvements are feasible. Industry representatives recommended using the Jack Brooks Regional Airport (BPT) in Southeast Texas as a hub with the ability to receive cargo aircraft. Interstate 10 and other main routes to Houston were flooded after Harvey, and heavy equipment and spare parts were being received at Bush Intercontinental Airport (IAH). There were delays in transporting these spare parts and equipment to industry sites in Southeast Texas. In some instances, helicopters were used to transport spare parts from sites in Houston to Southeast Texas. In addition, a warehouse in a location not prone to flooding may facilitate the centralized storage of spare parts and equipment (especially rental pumps) that may be needed in response to an emergency. Industry representatives also indicated that local and state authorities should prioritize assessing and communicating information regarding the conditions of main highways, bridges, and roads across Southeast Texas.

The following charts present the findings of PARM methodology for **plant shutdown**:

The next charts present the results of PARM methodology during **plant restart**:

- Restarting plant activity takes 1 to 4 weeks, however complete economic recovery takes much longer.
- Logistics problems to transport spare parts, raw materials and products hampered recovery.
- The waterway is a critical and strategic logistical resource. When the waterway shuts down it creates significant problems for shipments of raw materials and finished products.
- There is high reliance on pipelines which are more resilient to hurricanes and storms. Maintaining pipelines operational is an important task during

Best Practices of Risk Management and Lessons from Harvey

- Suppliers and plants keep higher levels of inventory, despite the additional holding and potential damage cost.
- As a preparedness measure post-hurricane plant restart training for all employees should be implemented.
- In some cases, large supplies and machinery were transported by helicopter from other plants to Lamar University's Montagne Center.
- A centralized transportation hub at the Beaumont airport can be a solution to the deficit of spare parts in post-hurricane recovery.
- Prioritized maintenance (zoned maintanace) of areas of the plant can help to address recovery issues more quickly.
- Flexible production practices help to identify which production processes can be restarted first and at what level (in the case of Harvey, in one plant jet fuel production started earlier than the production of other products because they had enough inventory in tanks).
- Funds are set-aside to purchase necessary supplies during the recovery period.

Finally, the charts that follow explain human resource management during plant shutdown and restarting procedures.

Hurricane's Impact on Human Resource Management

- Refinery shut down and especially recovery need extra manpower.
- Hiring new employees is a time-consuming procedure in the oil and gas industry due to safety training and background checks.
- Another human resource challenge is getting the labor force to work because of road closures.

Risk Related to Harvey

- Nearly half of the employees of the oil and gas industry were impacted personally.
- The safety of families and damage to the properties of the workers create difficulty in having them return to work.
- Personnel on-site was not able to leave to go home, while personnel off-site was not able to get to the refinery and chemical plants. As a result there is a need for temporary housing for emloyees.
- Strict guidelines and safety protocols add additional time in hiring new temporary personnel thus slowing down recovery.
- High demand for workers to recover from previous hurricanes around the nation in the same year made the job market very tight.
- Availability of vendors to supply food to employees on site was limited.
- Lack of medications for employees on-site became an issue.

After two substantial natural disasters (Harvey and Imelda), there was no permanent loss of production capacity of refineries and petrochemical plants in Southeast Texas. It is an important sign of the resiliency of the oil and gas industry. However, the shutdown caused a temporary decline in production capacity and large financial losses due to replacement and recovery expenses. Months after, oil and gas companies still spent money to fix the damage from Harvey and Imelda. These interruptions also have a negative impact on markets. employees and the natural environment. Any significant interruption in the oil and gas sector of the Gulf Coast region can

emergency plans from securing physically properties to personal evacuation and complete shutdown. Obviously, this kind of massive emergency plans interrupt the

5. Conclusion

In this study, researchers analyzed risk management practices of the oil and gas sector in Southeast Texas during Hurricane Harvey. This research recognized that resiliency and fast recovery of the oil and gas sector from natural disasters are important for the growth of the local economy of the Southeast Texas region. In areas where natural disasters are frequent, there is a need to analyze the risk management practices in order to plan local economic growth by

Recovery and resiliency depend on motivation, engagement, and collaboration of local stakeholders. Risk management knowledge, skills, and resources are crucial for resiliency and recovery. Robust private and public collaboration during risk management is needed before, during and after natural disasters. Risk management education programs can help to implement efficient risk management. Best risk management practices/tools, emergency simulations, and risk management training can help to be better prepared for hurricanes and storms.

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