# Introduction and Background

- 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 and used to determine the best risk management practices of recovery and resiliency from natural disasters.

# Introduction and Background

- The oil and gas sector of the economy, directly and indirectly, employed more than 50,000 people in Beaumont - Port Arthur MSA. It is more than 30% of the employed population of this region and the sector showed GDP annual compound growth of between 9.3% (2018/2017) and 21% (2017/2016)
- Examples of major employers in this sector are: refineries - Exxon Mobil, Motiva, Valero, Total, and petrochemical plants - Dupont, BASF, Chevron, Goodyear. These companies have billions of dollars of assets and revenues invested in the Southeast Texas region. The oil and gas sector is important for the stability and growth of the local economy.

# Introduction and Background

**Table 1. Major storms in Texas and financial losses**

| # | Storm | Year | Economic loss | Insured loss |
|---|---|---|---|---|
| 1 | Allison | 2001 | $ 12.0 billion | $ 5 billion |
| 2 | Rita | 2005 | $ 23.9 billion | $ 11 billion |
| 3 | Ike | 2008 | $ 43.0 billion | $ 21 billion |
| 4 | Harvey | 2017 | $ 125.0 billion | $ 30 billion |

# Introduction and Background

The most serious storm for the oil and gas sector was Harvey

Å 60% of U.S. upstream chemical manufacturing capacity impacted

Å shut down of:

- Å 25% of U.S. refining capacity (24 refineries - 3,871,449 barrels per day)
- Å 24.5% of oil production in the Gulf of Mexico (428,568 barrels per day)
- Å 25.9% of natural gas production (835 mln cubic feet per day)
- Å more than 50% of the US production of ethylene
- Å 50% of the US of polyethylene production
- Å 60% of the US production of polypropylene

Å 105 of 737 production platforms in the Gulf of Mexico were closed

Å disruption of more than one-third of US chemical production

Å pipelines were affected, transportation backlog

Å on September 15, 2017, a month after Harvey made landfall most refineries and chemical plants had restarted

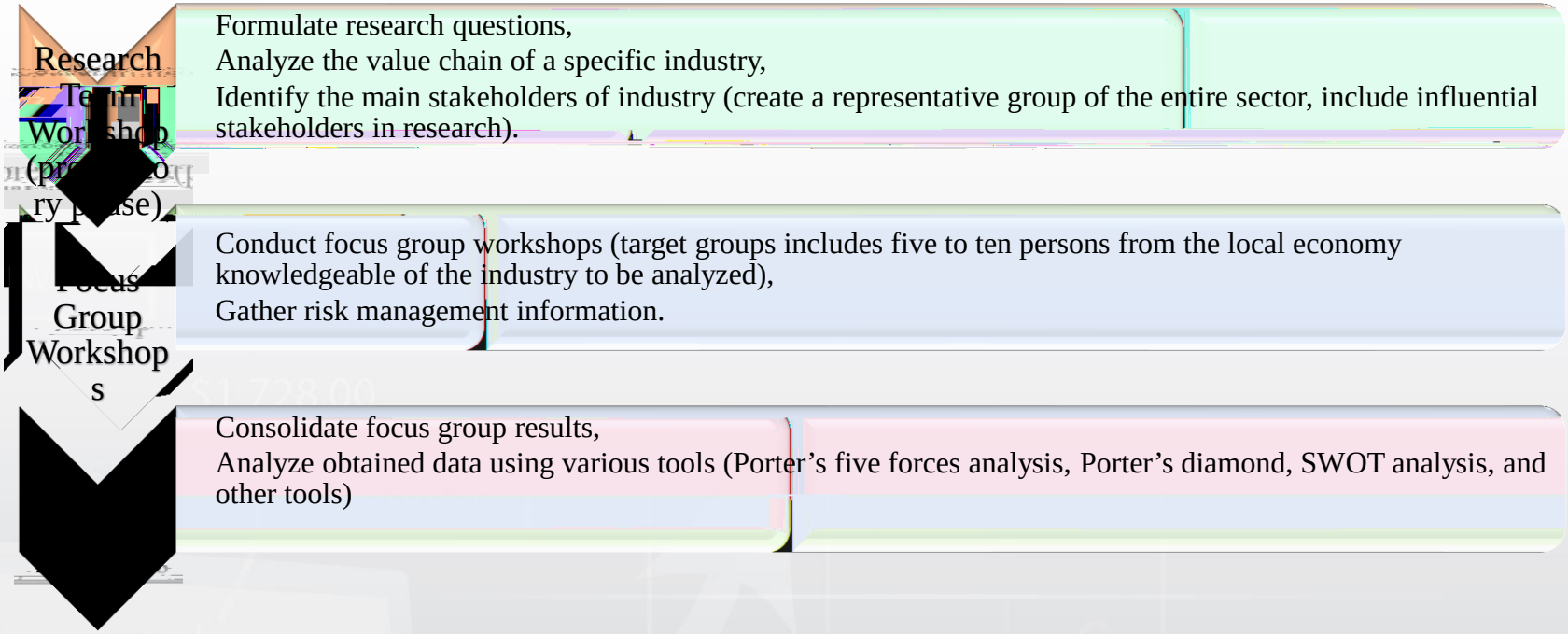
# Participatory Analysis of Risk Management (PARM)

- 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 Harvard Business School professor Michael Porter.
- The methodology uses Porterôs diamond and Porterôs five forces and value chain analysis to capture the structure of each sector of the local economy
- PACA methodology has been successfully used in more than twenty countries by researchers, universities, international organizations, local governments, and others.

# Participatory Analysis of Risk Management (PARM)

**Three core elements:**

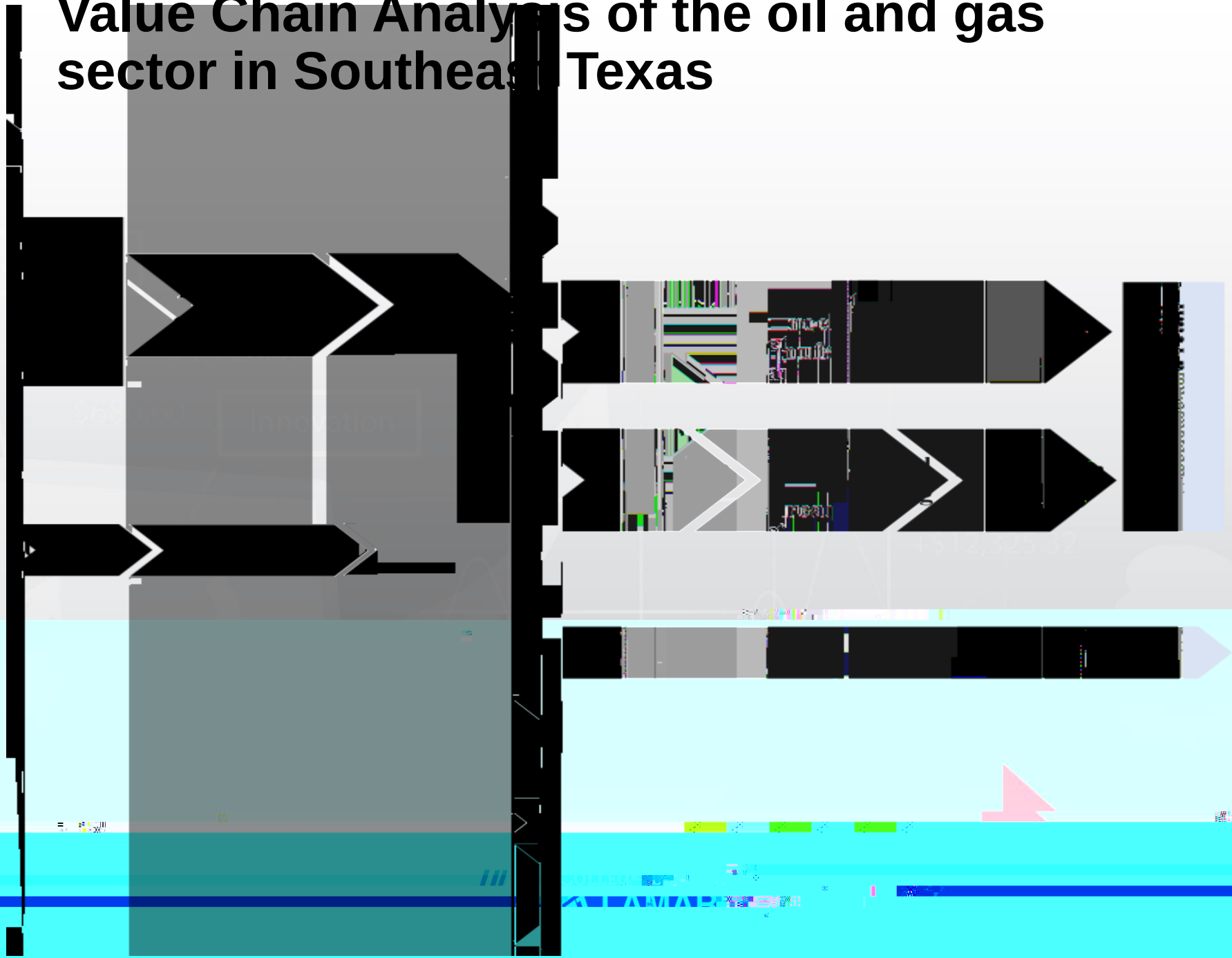
# PARM's workflow chart



# Application of PARM to the oil and gas sector in Southeast Texas

- What risks/problems did you experience during Hurricane Harvey?
- What were the most successful risk management strategies that you/your group used during Hurricane Harvey? Why?
- Were there risk management strategies that were not as successful that were used during Hurricane Harvey? Why?
- How did you manage the recovery process? What risks or challenges did you encounter during recovery?
- What role did technology (including communications) play in the Hurricane Harvey response? Which were the most critical technologies? What do you see as the role of technology in the future?
- What would you like to see happen if there is ever another hurricane in Southeast Texas and what steps will help us to move in that direction?

# Value Chain Analysis of the oil and gas sector in Southeast Texas



# Findings of PARM methodology for Plant Shutdown

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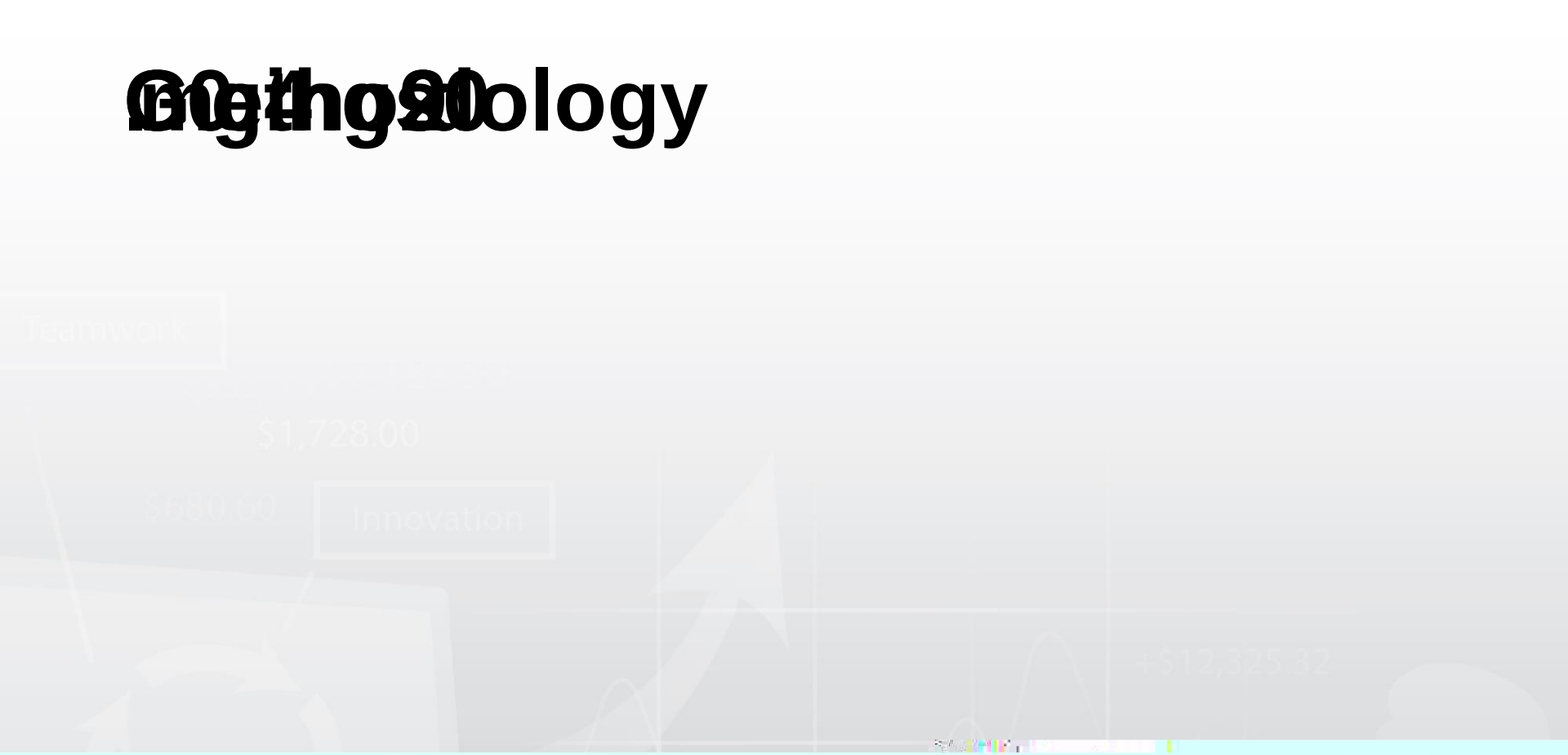
# Methodology



# Results of PARM methodology during Plant Restart

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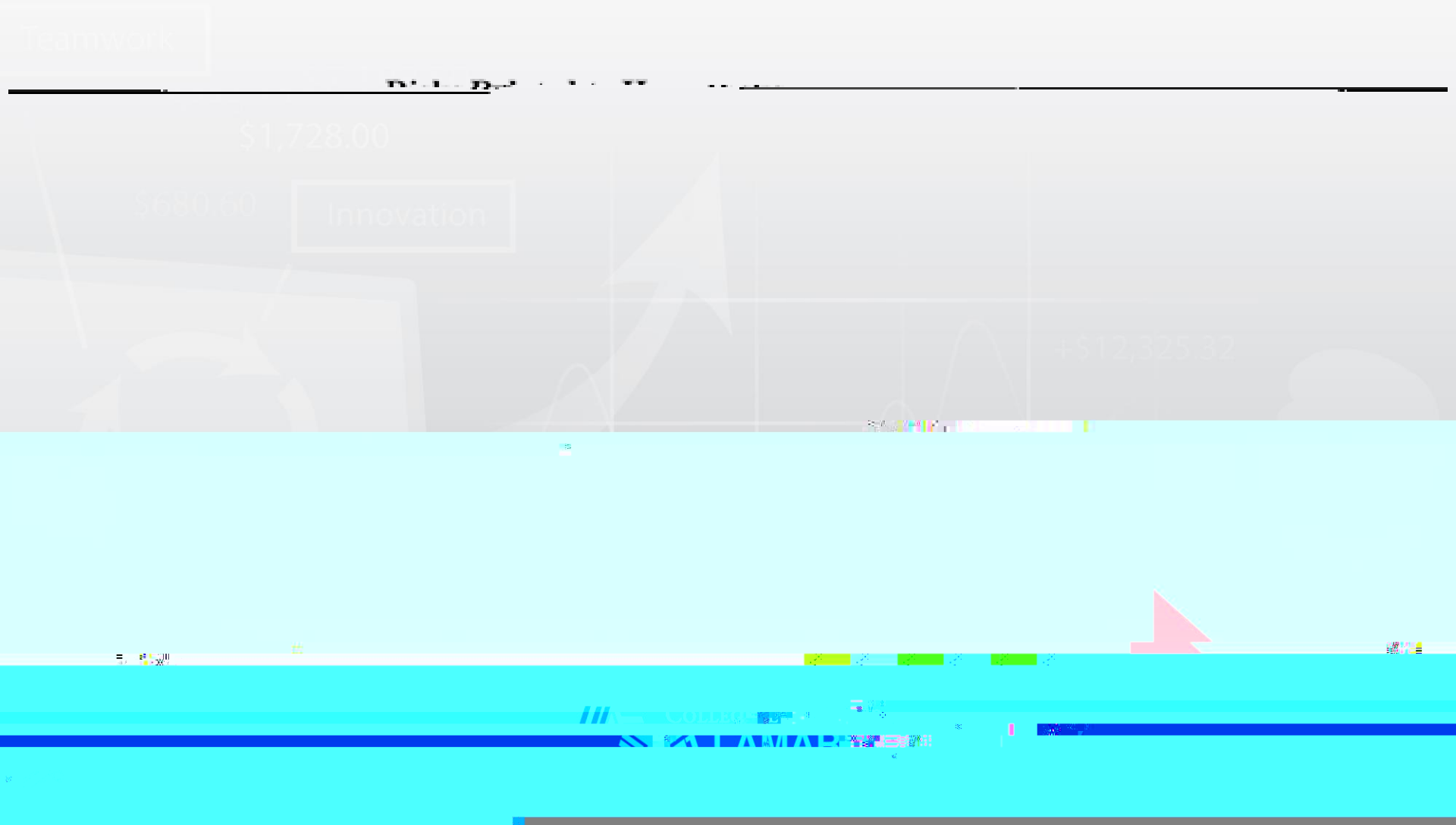
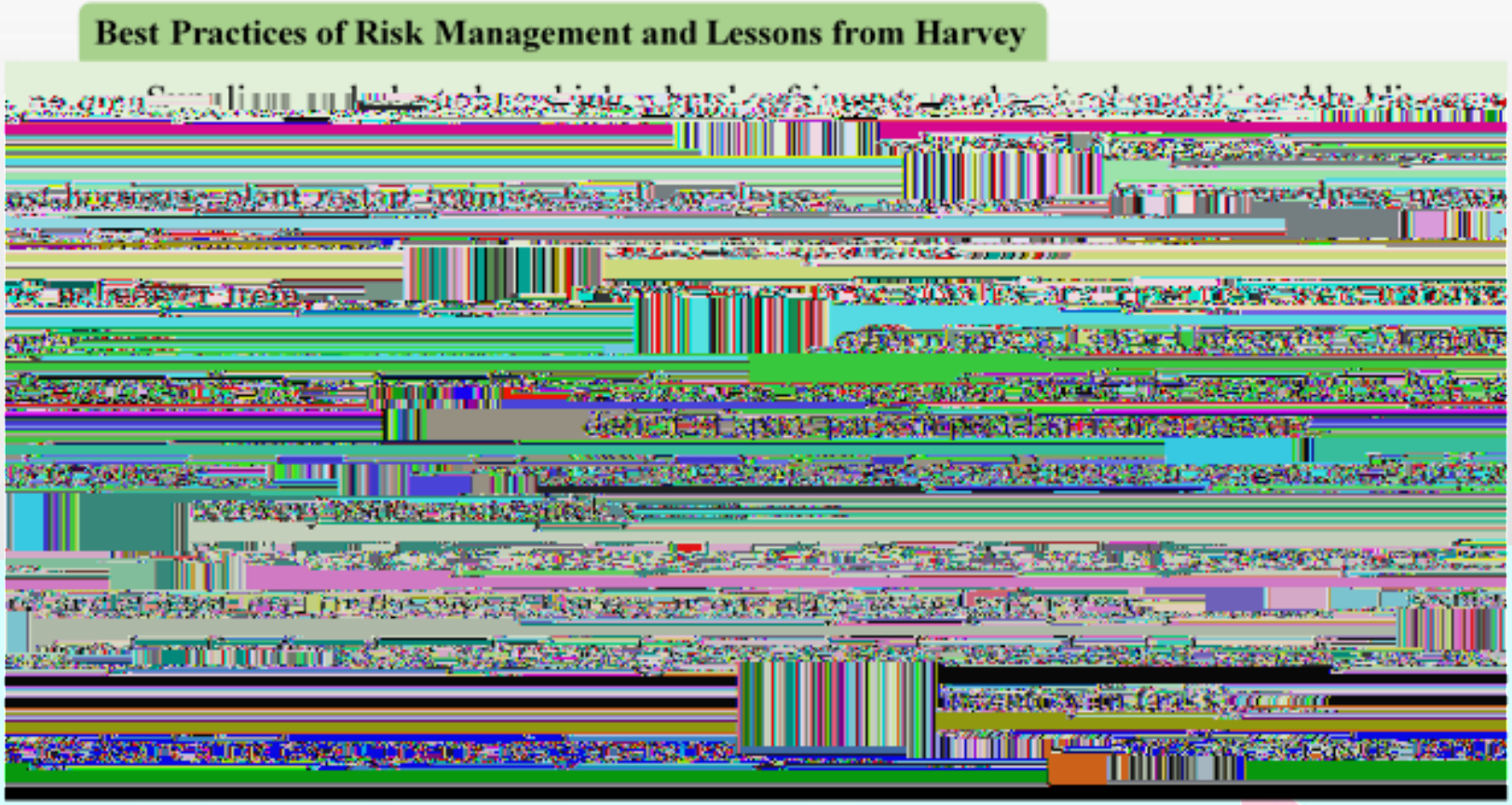


# Results of PARM methodology during Plant Restart



# Results of PARM methodology for Human Resource Mgmt during Plant Shutdown and Restart

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- Remote work for those employees who could complete their tasks from distance

# Conclusions

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.