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Assessing the Recovery Aftermaths of Selected Disasters in the Gulf of Mexico

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***Abstract*— This research examined quantitatively in-port grain loading levels during the periods preceding and succeeding selected human-made and natural disasters among U.S. Gulf Coast ports. The array of selected disasters consisted of the 2010 British Petroleum oil spill, the 2011 Mississippi River flood, Hurricane Katrina, Hurricane Gustav, and Hurricane Isaac. The outcomes of the analyses showed that the examined in-port Gulf Coast grain loading activities have not fully recovered and achieved the level of normalcy that existed before the examined cataclysms.**

***Key words*— Hurricane Gustav, Hurricane Katrina, Hurricane Isaac, Mississippi River.**

I. INTRODUCTION

Various maritime logistics systems exist along the Gulf Coast. However, despite their relevancy as distribution and supply chain intermediaries, ports along the Gulf Coast are susceptible to catastrophes. Regardless of the source of a cataclysm, whether human-made, technological, or natural origin, various attempts toward achieving recovery are implemented following a disaster. Essentially, during the aftermaths of calamities, societies attempt to achieve some amount of normalcy that existed before the disaster occurred. The hastiness with which recovery initiatives may progress was noted by John Stuart Mill in 1848. More specifically, Mill [1] noted:

"... perpetual consumption and reproduction of capital afford the explanation of what has so often excited wonder, the great rapidity with which countries recover from a state of devastation: the disappearance, in a short time, of all traces of the mischiefs done by earthquakes, floods, hurricanes, and the ravages of war. An enemy lays waste a country by fire and sword, and destroys or carries away nearly all the movable wealth existing in it: all the inhabitants are ruined, and yet in a few years after, everything is much as it was before" (p. 78).

Such observations of destruction are appropriate within the contexts of homeland security and modern disasters, including those that affect the Gulf Coast. Depending upon the severity of the calamity, the utter destruction of an impacted area may occur regardless of whether an incident occurred naturally or arose from human origins. When military forces were deployed along the Mississippi Gulf Coast following Hurricane Katrina, the region appeared as a war zone because of the extensive destruction that resembled devastation wrought by human conflict [2]. When describing the impacted region, Mississippi Governor Haley Barbour indicated that approximately 128 kilometers along the Mississippi Gulf Coast were destroyed, and that the town of Waveland, Mississippi, had no structures remaining that were inhabitable [2].

An evaluation of disaster aftermaths shows that the time and cost related to recovery are seldom predictable. Tragedies may incur vast financial costs and economic impacts with no guarantees of recovery. The economic impact of the 2011 flooding throughout the Mississippi River resulted in damage estimated in the range of $30 billion and $40 billion [3]. Inland, initial costs toward recovering the Delta were estimated to be approximately $1.5 billion (across a period of 50 years) solely to sustain the ailing level of society immediately after the incident, but to "not even recover" what had been destroyed [4, p. 121]. During 2012, following the 2010 British Petroleum (BP) Gulf Coast oil spill, adverse effects were estimated to be in the range of approximately $37.2 billion [5].

Additional costs were expected to also include facets of legal fees and financial losses regarding tourism [6].

Recovery, in regard to time and cost from the damage inflicted from major Gulf Coast hurricanes, has also proven hard to predict. Approximately five years after the incident, arguments existed that a full recovery from the disastrous Katrina had not occurred [7]. A decade later, some argued that full recoveries had not occurred with respect to certain facets of repopulation [8]. Lauded as the "most expensive natural disaster in US history," Hurricane Katrina generated estimated costs ranging between $125 billion and $133.8 billion [9, p. 402]. The estimated costs of the 2008 Hurricane Gustav were approximately $30 billion [10]. Although recovery is plannable and subject to an array of influences, not the least of which is the human factor, certain costs are influenced by humans deciding what should be repaired, recovered, or repopulated.

Sea ports along the Gulf of Mexico process a variety of international agricultural maritime shipments. Substantial quantities of agricultural products both arrive at and depart from the U.S. among these ports. Based on 2013 U.S. Department of Agriculture data [11], annually processed agricultural tonnages for the top five Gulf Coast ports are given as: New Orleans (61,622,451), Houston (9,221,729), Corpus Christi (4,107,913), Galveston (3,642,166), and Beaumont (1,705,432).

Gulf Coast ports are integral resources for distributing materials via the Mississippi River and are access portals internationally [11]. Agricultural products both arrive at and depart from the U.S. among such ports. Thus, their functioning has the potential of impacting not only local and regional economies, but also the national economy. Disasters that eliminate or impair the functioning of an economic component also have the potential of affecting the international economies and impacting homeland security and defense capacities [12]. Given such notions, calamities that impact the Gulf Coast region must be considered seriously as incidents whose potentials may affect economic performance through time with no guarantee that normalcy, as it existed before the event, will be achieved again afterward. Therefore, from the perspective of grain load processing throughput among Gulf Coast ports, this study examines facets of recovery with respect to selected human-made and natural incidents that ushered the twenty-first century.

II. FRAMEWORK

The conceptual framework for this research endeavor is derived from the emergency management cycle (EMC). The EMC is a cyclical resource through which organizations may craft methods for experiencing and coping with calamities. The EMC consists of four phases: 1) preparedness, 2) mitigation, 3) response, and 4) recovery [13]. Preparedness involves various aspects of identifying threats, planning accordingly, and examining contingency courses of actions. Mitigation or prevention involves diminishing or quashing the negative effects of a calamity. Response consists of enacting a specific plan or course of action when threats arise. Recovery consists of invoking courses of actions that attempt to achieve much or all of the state of existence and lifestyle that occurred before the calamity happened. As recovery progresses, methods of assessment and evaluation occur to benchmark normalcy [13]. Therefore, this study approaches Gulf Coast events from the perspective of the recovery EMC phase. No guarantee exists that full recoveries are possible or will be accomplished at some point succeeding disasters. Given this notion coupled with various disasters affecting the Gulf Coast region, this study assesses port grain loading recovery logistics characteristics preceding and following each of the examined catastrophes.

Preceding studies incorporated a variety of perspectives to examine facets of recovery. Zottarelli [14] investigated recovery associated with Hurricane Katrina from an employment perspective. Individuals who moved exhibited less chance of experiencing recovered employment [14]. Lamanna, Williams, and Childers [15] examined the hotel industry near New Orleans, and found that hotels resumed basic operations effectively between three and five days succeeding Hurricane Gustav. The efficiency and effectiveness of resumption were improved from lessons learned regarding experiences with Hurricane Katrina [15]. Lambert, Duhon, and Peyrefitte [16] examined the BP oil spill aftermath from a supply chain perspective using a systems approach. The study suggested that relief for any one point within the supply chain did not necessarily guarantee relief for any other components [16]. Regardless of improvement, impeded environments existed after calamity affecting normalcy [14, 15, 16].

Given these notions, this study embodies a framework accommodating recovery and normalcy. Although attempts may be made to achieve full normalcy during the aftermath of a calamity, no guarantees exist that any locality will eventually appear and function as it was before the incident occurred. Through studying logistics throughput and grain travel movements along the Gulf Coast

following various disasters, including hurricanes, floods, and an oil spill disaster, some observations may be made toward gleaning an understanding of 'normalcy' achievements following substantial incidents. Thus, this study examines the before versus after perspective regarding selecting disasters.

III. The Response to Calamity

Although it is impossible to imagine and prepare for every possible threat scenario that affects an organization, identifying and understanding major threats and preparing for them accordingly is a wise investment of organizational resources strategically [13]. Through preparedness, during modern times, some amounts of both human life and physical infrastructure may be spared from devastation. Response plans should be crafted with respect to the all-hazards approach context of calamities and incidents that accommodates both reasonably identifiable human-made and natural disasters [17].

All calamities necessitate some form of response. The responses to Gulf Coast incidents marshaled resources locally, regionally, and nationally to provide assistance to the affected regions. The response efforts included the necessities of sustaining human life (e.g., foodstuffs, medicine, clothing, sanitation, etc.) and financial contributions originating from the benevolence of individuals, commercial organizations, and government organizations. For instance, Wal-Mart donated approximately $20 million of cash resources following Hurricane Katrina, foodstuffs for approximately 100,000 meals, and 1,500 loads of free resources [18]. Responses to major calamities often necessitate commitment of military resources to supplement civilian operations. Gulf Coast storms necessitated military involvement during the aftermath of the storm. Legislation for defense appropriations included approximately $29 billion toward federal financial resources for recovery efforts [19]. Additionally, among states that possessed their own state defense force (SDF), governors deployed their respective SDFs in conjunction with their National Guard forces thereby leveraging SDFs as force multipliers to better response effectiveness. For instance, involving Hurricane Katrina, SDFs were deployed during the aftermath of the storm to support disaster operations [20].

IV. Recovery and Normalcy

At some point following a calamity, the phase recovery will cease and the area impacted will enter a phase of growth and development no longer connected to the disaster, reaching some level of normalcy. When pursuing normalcy through recovery efforts, organizations must strengthen themselves to become more resilient against future incidents. Such notions may be considered from the perspective of the 1900 hurricane that devastated Galveston, Texas. Following the hurricane, the recovery period necessitated changing the governmental structuring of Galveston to accommodate considerations and endeavors that were related to safeguarding the city against potential future disasters [21, 22]. Recovering from the incident necessitated the erecting of bulwarks to guard against sea swells, and the raising of the city physically [21, 22].

Such actions reflected the reality of a new normal for the Galveston society. The state of existence that Galveston exhibited before the hurricane was destroyed by the storm. Recovering from the storm involved the manifestation of a new reality that defined existence as normal. Despite its best attempts to recover from the incident and to resume some normalcy among the lifestyles of its citizenry, Galveston was changed by the disaster and the pre-disaster normalcy would be replaced with a new post-disaster normalcy shaped by the recovery efforts [21, 22]. This observation provides a timeless lesson regarding recovery – no guarantee exists that a locale shall completely recover and achieve its previous state of normalcy that existed before a calamity occurred. During modern times, this notion is witnessed regarding the recovery from Hurricane Katrina. For instance, nearly a decade later, approximately 53% of the displaced adults had returned to New Orleans [23]. Thus, even New Orleans experienced a new conceptualization of 'normal' succeeding Hurricane Katrina.

V. Selected Gulf Coast Disasters

Disasters may arise from human-made, technological, or natural origins. Although disasters are unique, they share some commonness with its predecessors. Each disaster experience provides lessons learned that may be incorporated toward either avoiding or mitigating future hazards. Regardless, despite the best attempts of preparedness, no community is insusceptible to calamities.

Throughout hurricane season, ranging between June 1 and November 30, hurricanes represent an expected Gulf Coast danger that may affect society. The violence wrought by nature is often

devastating and traumatic. Despite the damages inflicted by hurricanes Gustav and Isaac, in the terms of destruction, Hurricane Katrina remains the costliest hurricane in American history [24]. Specifically, Katrina generated approximately $75 billion in costs along the Gulf Coast states of Alabama, Mississippi, and Louisiana, and resulted in 1,300 deaths [25].

A. 2010 British Petroleum (BP) Oil Spill

The 2010 British Petroleum (BP) Gulf of Mexico oil spill was deemed to be the worst offshore oil spillage in American history [26]. Approximately 206 million gallons of oil leaked during the incident [12]. The severity and devastation wrought by this incident surpassed the effects of the 1980s Exxon Valdez incident which leaked approximately 11 million gallons of oil [12, 13]. The response to the incident incorporated a variety of resources, ranging from prisoners to federal agencies [24]. During 2015, despite the best efforts to effect recovery, communities within the Gulf Coast region had not fully reclaimed their economic potentials that existed before the incident [27].

B. 2011 Mississippi River Flood

Flooding is an expected danger throughout the Gulf Coast region. A notable calamity that affected the Gulf Coast region was the 2011 Mississippi River flood. During 2011, rainfall generated an especially voluminous amount of water along the Mississippi River leading to the Gulf Coast. The 2011 Mississippi River flooding was deemed "among the largest and most damaging recorded along the waterway in the past century," and was commensurate with the 1993 and 1927 floods [3, p. 135]. For the first time, the calamity necessitated the opening of all three spillways regionally along the Mississippi and Missouri rivers [3]. It marked the first time in 37 years that flooding necessitated opening the Morganza spillway [3].

Flooding interjected unprecedented amounts of water among inland areas. Approximately 6.35 million acres were flooded whereas approximately 1.5 million backwater and floodway acres were unused [28]. Among some urban regions, such as Memphis, Tennessee, the Mississippi River spanned six times its normal width [29]. Runoff water amounts were approximately 61 million acre-feet representing the highest runoff levels in 114 years [28]. Along the Missouri, the Big Bend and Garrison spillways, two of the main-stem dams, were operated for the very first time [28]. Destruction ravaged small towns and communities along the flooded regions. For instance, near Tunica and Greenville, both in Mississippi, over 300 and 800 homes were destroyed, respectively [30]. Not since the floods of 1927 and 1937 had the region experienced such flooding devastation [31]. Essentially, the 2011 flood surpassed the flooding devastation of the 1920s and 1930s [17].

C. Hurricane Katrina

Hurricane Katrina formed as a tropical depression on August 23, 2005 [19]. The storm rapidly increased in magnitude and strength, and was classified as a Category 1 hurricane on August 25 [32]. After crossing the Florida peninsula, the storm entered the Gulf of Mexico where it was classified as a Category 3 storm on August 27, 2005 [32]. Although it was eventually classified as a Category 5 storm, Hurricane Katrina was downgraded to a Category 3 storm when it impacted the shores of Mississippi and Louisiana on August 29, 2005 [19].

D. Hurricane Gustav

A notable calamity that affected the Gulf Coast region was the 2008 Hurricane Gustav. Hurricane Gustav was the first major hurricane since Hurricane Katrina [33]. Some estimates indicate that Hurricane Gustav resulted in approximately $15 billion in property damages, and approximately $5 billion in economic activity losses [34].

E. Hurricane Isaac

During 2012, Hurricane Isaac resulted in between $1.5 billion and $2 billion in damages [35]. Its costs were estimated to be at least approximately $900,000,000 [36]. It necessitated one of the greatest evacuations to occur throughout U.S. history [25]. Hurricane Isaac caused the evacuation of approximately 35,000 personnel offshore personnel thereby resulting in the cessation of approximately 23% of national gas and oil production and exploration [25]. Daily, the cost of these terminated energy activities was approximately $130 million [25].

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VI. Research Questions

The primary research question was stated as follows: is there a statistically significant difference between levels of U.S. Gulf vessel grain loading activity at Gulf Coast ports before the examined calamity versus after the examined calamity? Derived from this research question, the general form of the null hypotheses within this research study is given as follows:

$H_{0,0}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before the examined incident versus after the examined incident.*

This general hypothesis was used to craft specific hypotheses for the 2010 BP Oil Spill, the 2011 Mississippi River flood, Hurricane Gustav, Hurricane Katrina, and Hurricane Isaac. Respectively, these hypotheses are itemized as follows:

$H_{0,1}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before the 2010 BP oil spill incident versus after the 2010 BP oil spill incident.*

$H_{0,2}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before the 2011 Mississippi River flood versus after the 2011 Mississippi River flood.*

$H_{0,3}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Gustav versus after Hurricane Gustav.*

$H_{0,4}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Katrina versus after Hurricane Katrina.*

$H_{0,5}$ *No statistically significant difference exists between levels of in-port U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Isaac versus after Hurricane Isaac.*

VII. Methodology

The methodology for this study involved the use of data obtained from the U.S. Department of Agriculture. The data set spanned a period of 21 years between the first quarter of 1995 and the first quarter of 2016. Data items represented the quantities of aggregated Gulf Coast in-port grain loading events that occurred weekly throughout the considered period. The data were separated into two separate groupings (before and after) with respect to the event dates of each of the considered calamities. With respect to each of the examined incidents, separate data groups, representing before and after perspectives of the respective cataclysm, were examined via hypothesis testing.

Data processing was accomplished via one-way analysis of variance (ANOVA) to examine the differences between grain loads among U.S. Gulf of Mexico ports before and after the following incidents: 1) 2010 British Petroleum oil spill, 2) 2011 Mississippi River flood, 3) 2008 Hurricane Gustav, 4) 2005 Hurricane Katrina, and 5) 2012 Hurricane Isaac. The Omega-squared method was used to examine the characteristics of effect size regarding the hypothesis testing outcome.

Within this study, the dependent variable represented resulting load change whereas the independent variable consisted of data preceding the event and data succeeding the event thereby representing two groupings of data. The means of the examined data sets were evaluated for equality via hypothesis testing. The p-value approach represented the hypothesis testing method for this study. The level of significance for performing the hypothesis test was 0.05.

Considerations of measuring change through time quantitatively were pertinent regarding the logistics system along the Gulf Coast. The percent change method was used to explore facets of

such change. Within this study, the value of percent change was calculated to examine quantitatively the amount of change that occurred regarding the periods before and after the examined incidents.

VIII. FINDINGS

Displayed within the following tables are characteristics of central tendency and dispersion with respect to processed quantities of grain tonnages among Gulf Coast ports.

Table 1: BP Oil Spill Data Characteristics

Period	Mean	Standard Deviation	Variance	Median	Mode
Cumulative	34.22	12.18	148.26	33	29
Before Event	33.27	11.10	123.27	32	29
After Event	36.67	14.31	204.67	36	33

Note. Demarcation point separating event data was April 20, 2010. Units of measurement represented weekly values of in-port events.

Table 2: Mississippi River Flood Data Characteristics

Period	Mean	Standard Deviation	Variance	Median	Mode
Cumulative	34.22	12.18	148.26	33	29
Before Event	33.28	11.12	123.63	32	29
After Event	36.88	14.35	205.80	36	33

Note. Demarcation point separating event data was June 2, 2010. Units of measurement represented weekly values of in-port events.

Table 3: Hurricane Gustav Characteristics

Period	Mean	Standard Deviation	Variance	Median	Mode
Cumulative	34.22	12.18	148.26	33	29
Before Event	32.54	10.56	111.52	32	32
After Event	35.88	15.20	230.93	29	27

Note. Demarcation point separating event data was August 25, 2008. Units of measurement represented weekly values of in-port events.

Table 4: Hurricane Katrina Data Characteristics

Period	Mean	Standard Deviation	Variance	Median	Mode
Cumulative	34.22	12.18	148.26	33	29
Before Event	32.54	10.56	111.52	32	32
After Event	35.88	15.20	230.93	29	27

Note. Demarcation point separating event data was August 23, 2005. Units of measurement represented weekly values of in-port events.

Table 5: Hurricane Isaac Data Characteristics

Period	Mean	Standard Deviation	Variance	Median	Mode
Cumulative	34.22	12.18	148.26	33	29
Before Event	32.89	11.33	128.30	32	29
After Event	40.73	39.50	196.00	39	33

Note. Demarcation point separating event data was August 30, 2012. Units of measurement represented weekly values of in-port events.

A. *BP Oil Spill Findings*

Using the p-value approach, hypothesis testing revealed a statistically significant outcome (p = 0.00002; α = 0.05) regarding the considered hypothesis corresponding to the BP oil spill. Thus, the null hypothesis, H_0, was rejected. It appears that a statistically significant difference existed between in-port levels of U.S. Gulf vessel loading activity at Gulf Coast ports before the 2010 BP oil spill incident versus after the 2010 BP oil spill incident. The effect size value was determined to be 0.0157 thereby suggesting little effect between the independent and dependent variables. The percent change outcome value was determined to be 10.21%. This outcome suggests increases regarding the total loading activities occurring with respect to the periods before and after the 2010 BP oil spill, however, at a diminished level than that which been trending prior to the disaster. The examined period ranged from 15 years before the event to six years after the event.

B. Mississippi River Flood Findings

Using the p-value approach, hypothesis testing revealed a statistically significant outcome (p = 0.00001; α = 0.05) regarding the considered hypothesis corresponding to the Mississippi River flood. Thus, the null hypothesis, H_0, was rejected. It appears that a statistically significant difference existed between in-port levels of U.S. Gulf vessel loading activity at Gulf Coast ports before the 2011 Mississippi River flood versus after the incident. The effect size value was determined to be 0.0175 thereby suggesting little effect between the independent and dependent variables. The percent change outcome value was determined to be 10.26%. This outcome suggests increases regarding the examined total loading activities occurring with respect to the periods before and after the 2011 Mississippi River flood, however, at a diminished level than that which had been trending prior to the disaster. The examined period ranged from 16 years before the event to five years after the event.

C. Hurricane Gustav Findings

Using the p-value approach, hypothesis testing revealed a statistically significant outcome (p = 0.00005; α = 0.05) regarding the considered hypothesis corresponding to Hurricane Gustav. Thus, the null hypothesis, H_0, was rejected. It appears that a statistically significant difference existed between in-port levels of U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Gustav versus after the incident. The effect size value was determined to be 0.0342 thereby suggesting little effect regarding the interaction between the independent and dependent variables. The percent change outcome value was determined to be 14.42%. This outcome suggests increases regarding the total examined loading activities occurring with respect to the periods before and after Hurricane Gustav, however, at a diminished level than that which had been trending prior to the disaster. The examined period ranged from 13 years before the event to eight years after the event.

D. Hurricane Katrina Findings

Using the p-value approach, hypothesis testing revealed a statistically significant outcome (p = 0.00187; α = 0.05) regarding the considered hypothesis corresponding to Hurricane Katrina. Thus, the null hypothesis, H_0, was rejected. It appears that a statistically significant difference existed between in-port levels of U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Katrina versus after the incident. The effect size value was determined to be 0.0342 thereby suggesting little effect regarding the interaction between the independent and dependent variables. The percent change outcome value was determined to be 6.86%. This outcome suggests increases regarding the total loading activities occurring with respect to the periods before and after the 2005 hurricane, however, at a diminished level than that which been trending prior to the disaster. The examined period ranged from 10 years before the event to 11 years after the event.

E. Hurricane Isaac Findings

Using the p-value approach, hypothesis testing revealed a statistically significant outcome (p = 0.00000; α = 0.05) regarding the considered hypothesis corresponding to Hurricane Isaac. Thus, the null hypothesis, H_0, was rejected. It appears that a statistically significant difference existed between in-port levels of U.S. Gulf vessel loading activity at Gulf Coast ports before Hurricane Isaac versus

after the incident. The effect size value was determined to be 0.0583 thereby suggesting little interaction between the independent and dependent variables. The percent change outcome value was determined to be 23.91%. This outcome suggests increases regarding the total loading activities occurring with respect to the periods before and after the 2012 hurricane, however, at a diminished level than that which been trending prior to the disaster. The examined period ranged from 17 years before the event to four years after the event.

IX. Conclusions and Recommendations

None of the null hypotheses were retained. Instead, they were rejected in favor of the hypotheses that suggested change existed regarding port throughputs along the Gulf Coast. Essentially, the outcomes suggest that neither cumulatively nor individually among any of the areas has recovery fully occurred with respect to seaport grain load processing following the examined incidents. Years after each of the examined calamities, a new 'normal' exists among the locations.

Although the opening paragraph cited Mill's (1848, p. 74) notion of disaster recovery indicated that "… yet in a few years after, everything is much as it was before," the phrase "much as it was" does not imply a completely identical state of being will be achieved when society attempts to recover from an incident. The negative effects of disasters have affected regional and national economies multiple times. Despite the best efforts to achieve normalcy after an incident occurs, not all scenarios generate a full recovery. For instance, the city of Galveston, Texas never regained its economic status as a Gulf Coast port after experiencing a hurricane in 1900 near the turn of the twentieth century [21, 22]. Similarly, New Orleans did not fully reclaim its former glory following Hurricane Katrina [37]. Thus, this study further strengthens the findings of White [37] and Sastry and Gregory [23] regarding observations that full recovery did not always occur historically whereby 'normalcy' existed as it did before the occurrence of a catastrophe.

Disaster management culminates in the EMC's final stage of recovery in which some attempt toward achieving normalcy occurs. The aftermath of disaster often may invoke new perspectives and considerations of 'normal' that differ from those that existed before experiencing a calamity. Each of the tested hypotheses showed significant outcomes thereby indicating some aspect of change regarding grain processing among the examined ports. Thus, quantitatively, a different reality and version of normal existed after each of the examined incidents. When viewed through the lens of disaster aftermaths (e.g., Galveston, Hurricane Katrina, and so forth) in which the normalcy that existed before the disaster was never again achieved, the outcomes of this study, involving port grain processing, are commensurate with various historical precedents of recovery along the Gulf Coast involving substantial calamities.

Despite the findings of this study, it was limited to solely considerations of grain logistics and throughput along the Gulf Coast. Ports along the Gulf Coast represent intermediary stations for distributing items nationally and internationally. Thus, future research studies may examine the same catastrophes using a similar approach, such as examining the before and after perspectives of consumer goods. Since the authoring of this article, the year 2017 witnessed three additional hurricanes (Harvey, Irma, and Nate) that wreaked havoc and generated much destruction among states in the Gulf Coast. After sufficient logistics data are available, future studies may examine the impacts of these storms.

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