The Assessment of Economic Losses of Typhoon Mangkhut in Hongkong

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Abstract

Typhoon Mangkhut was a tropical cyclone that seriously affected Hongkong in 2018. Mangkhut caused hundreds of injuries and massive economic costs. This paper assesses the direct and indirect economic losses in consequence of Typhoon Mangkhut and the leading factors behind such losses

1. Overview of Typhoon Mangkhut

Typhoon Mangkhut was an infamous tropical cyclone that formed in 2018. Mangkhut developed on the Western Pacific and traveled eastward and northward as it intensified. Starting from a mere tropical depression, Mangkhut escalated to one of the strongest typhoons ever formed in the Western Pacific. It was soon marked as a Category 5-equivalent typhoon with "peak one-minute sustained winds of 285 km/h (180 mph)", surpassing the Category 5 standard by as least 23mph. Mangkhut made its first landfall at Luzon, Philippines on September 14 with an estimated maximum sustained wind of 250km/h (Hong Kong Observatory HKO, 2018). After devastating Luzon, Mangkhut weakened and shifted its route northwestward towards the coast of Pearl River delta, one of the most enormous and most populous metropolises in the world. On 15 September, Mangkhut entered the Southern China Sea (SCS) and started approaching near Hongkong. On midnight 15 September, HKO issued No. 8 Storm Signal while Mangkhut was about 410 km southeast of Hongkong (HKO, 2018). As Mangkhut got closer and as the winds strengthened, HKO increased the alert to No.10 Storm Signal on 16 September morning, which is the highest alert level for tropical cyclones in Hongkong (HKO, 2018). Among the 16 "Signal No.10" typhoons ever issued by HKO over the decades, Mangkhut invoked the No.10 signal farthest away (HKO, 2018). Nonetheless, the huge rain bands of Mangkhut produced sustained

precipitation and remarkably strong winds. The typhoon approached closest to Hongkong at around noon on 16 September, and made its landfall in Guangdong China at around 5 pm, 150km to the west of Hongkong (HKO, 2019).

Figure(1): A illustration of the track of Mangkhut approaching Hongkong

The No. 10 Storm Signal lasted for 10 hours, which was the second-longest next to Typhoon York in 1999 (Choy, 2020). During the day, radar showed that an intense rainband between 100 and 200 kilometers swept across Hong Kong, which brought a maximum 60 minutes mean wind speed of 157km/h at Cheung Chau station. This is the second-highest wind speed recorded for No. 10 storms at that station (Choy, 2018). The main reason why Mangkhut produces more violent and enduring winds than most other No. 10 storms is the special geographic location of Hongkong with respect to Mangkhut's core. Hongkong is located to the right of the rain band for the entire duration of the storm. The right rain band is generally more boisterous than the left rain band because the counter-clockwise rotation of the storm is consistently fusing precipitation and winds from the sea to the right rain band. Furthermore, the storm surge, which is the rise of sea level

induced by strong winds carrying waves paddling against the coast, raised the water level in Hong Kong generally by more than 2 meters (Choy, 2018). Hongkong is an island city with most of its business and residential area constructed near the coast. A rise in the sea level leads to severe flooding in areas that are low and populated. During the crossing of Mangkhut, almost all coastal areas reported flooding and a rise in sea level ranging from 3 to 4 meters. Five of the six tide station observed record-breaking storm surge. (report on super typhoon (HKO, 2018).

Figure(2): A residential area flooded by storm surge caused by Mangkhut.

The flooding was aggravated by the abundance of rainfall. Over 150 mm of rainfall were reported generally over Hong Kong, which is a typical amount among No.10 typhoons (HKO, 2018).The combination of strong winds, extensive precipitation, and storm surge caused enormous impacts on Hongkong‘s infrastructure and its normal functioning.

HKO lowered the Storm Signal to No.8 at 7.40 pm the same day as the storm moved more distant from Hong Kong, and eventually canceled all signal warnings on the evening the next day (HKO, 2018).

2. Direct Economic losses

This paper mainly examines the economic losses caused by typhoon Mangkhut in Hongkong and the contributing factors behind them. The first part addresses the direct economic losses, while the second part discusses the indirect economic losses.

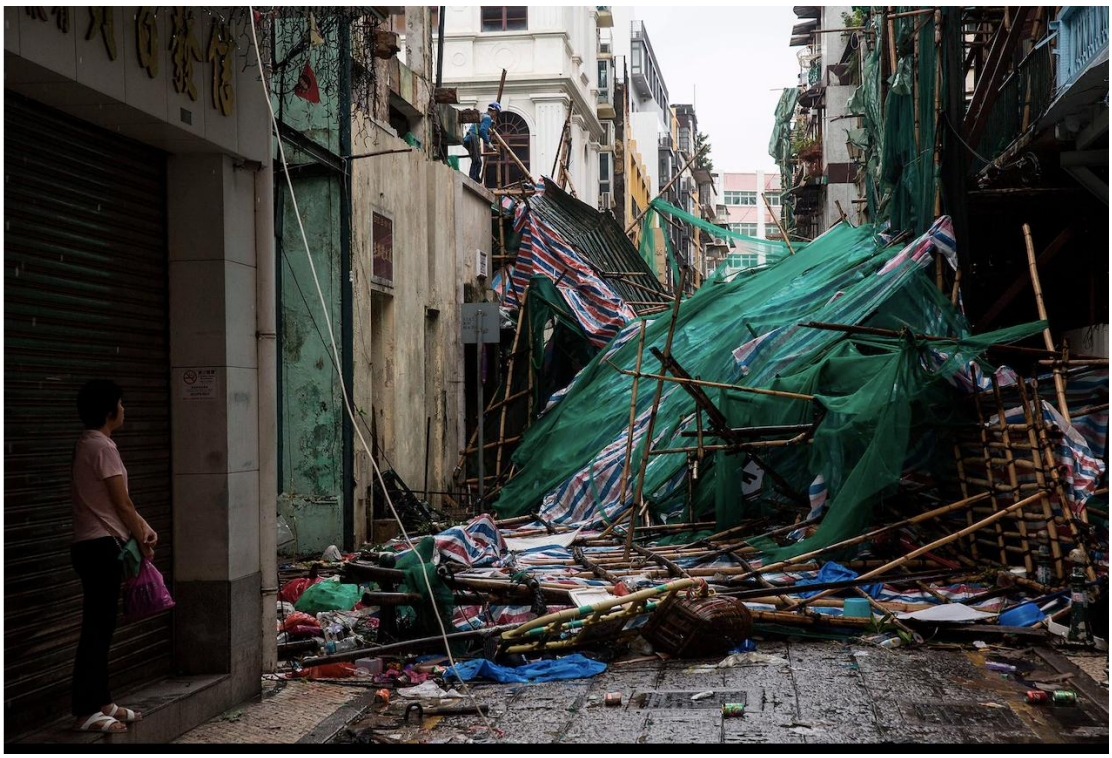
Direct economic losses are considered as the loss of properties that are estimable. Overall, typhoon Mangkhut caused approximately HK$ 4.6 billion in losses. The total economic losses are comprised of two main sectors. The losses from public infrastructure and government utilities are considered as the public sector. This sector consisted of around HK$ 900 million or 19.5% of the total economic losses (Choy, 2020). During the passage of Mangkhut, there were at least 60,000 tree falling reports, and more than 500 reports of smashed windows or glass curtain walls **(**Choy, 2018)**.** Various roads and rails were either blocked by trees or flooded. This requires the government's financial supports to hire works to reconstruct damaged public utilities. Furthermore, the strong winds battered numerous government facilities such as road signs, post boxes, guardhouses, traffic lights, lamp posts, etc (Choy, 2020). The other sector is the private sector losses and is estimated through the insurance claims calculated by HKFI (Hong Kong Federation of Insurers). The losses for this sector were around HK$ 3.7 billion or 80% of the total economic losses (Choy, 2020)**.** Private properties such as vehicles were impaired by fallen trees or other fallen items, residences were flooded and soaked, and personal items were blown away or displaced. 40,000 households were cut off from electricity during the storm, and 13,500

households still suffered from power outages after a day. Water supply in some areas was also interrupted as vessels were destroyed by large waves (Choy, 2018). Both the direct impact of Mangkhut and the subsequent interruption of water and electricity supply created great losses to Hongkong citizens.

Figure(3): An image of a play ground impaired by a fallen tree.

For typhoon Mangkhut, Hongkong's high vulnerability is the main underlying determinant of this huge economic loss. Hongkong is located adjacent to Guangdong province, which is one of the most southern provinces in China. Only the north side of Hongkong is connected to mainland China and all other sides are facing the Southern China Sea. The Hongkong territory is consists of several islands, each of which is characterized by hills (relatively high elevation) at the center and flats (low elevation) at the surrounding coastal areas. Locating at the south of Hongkong and facing SCS, the Hong Kong island and Kowloon district are the two most populous areas in Hongkong. They are also the most vibrant part of Hongkong in terms of businesses activities and recreation. Hongkong has an approximately 7.4 million population, and about 3.5 million, or 47% of the entire population, are cramped in Hong Kong island and Kowloon, which only accounts for 11% of Hongkong's land area (Census and Statistics Department C&SD, 2020). The population

density of Hongkong Island is astonishing 15,320 persons/sq.km and Kowloon's population density reaches a shocking 49,060 persons/sq.km (Census and Statistics Department C&SD, 2020). In accommodation to the condensed population, the residential buildings are built tall and tightly packed together. Under the state of sustained strong winds up to 157km/h, items from personal apartments fall from high places and cause further economic damages. Geographically, Hong Kong Island and Kowloon are the areas most prevalent to storm surges since they have long coasts lines and a dense population. As the waves rush into the city, more housing, apartments, small businesses shop, and personal items will be damaged. Most of the buildings are equipped with underground parking that is at risk of flooding. As a result, the direct economic losses of private properties and public utilities caused by typhoon-induced storm surge and strong winds on Hongkong, specifically the populous areas, are immense.



Figure(4): An image showing the destruction by strong winds in a narrow ally.

3. Indirect Economic losses

The indirect economic losses by typhoon Mangkhut is important yet immeasurable. The rest of this paper discusses some major aspects of indirect economic losses and the significance of considering them.

As typhoon Mangkhut swept through Hongkong and devastated residences, the skyscrapers at CBD in Hongkong island and Kowloon are as well inevitably destructed. Even though most offices in high-rises are safe from storm surges, they are not safe from violent winds. The strong winds from Mangkhut scattered some offices' windows and teared up the interior. Paper documents, computers, as well as some other appliances were carried away by the winds. As denoted by HKO, there were at least 500 reports of smashed windows or glass curtain walls (Choy, 2018). There were numerous videos recording papers flying out from broken windows and the offices being pulled apart by the winds. Some companies took approaches such as blocking the windows with wooden panels or taping the windows to mitigate the impact. Nonetheless, most company offices were demolished and unable to use for an extended period of time.

Figure(5): The image of a skyscraper right after Mangkhut. Windows of offices are scattered.

The interruption to the normal operations of companies caused severe indirect losses. Companies have to postpone work or even cancel work or projects that underwent unrecoverable damages. More importantly, the loss of documents and data on computers leads to more disastrous and unforeseeable impacts on most companies, especially the companies that rely profoundly on data and records. The majority of these losses are not claimable by insurance nor estimable by the government, thus, present as an outstanding factor of indirect economic losses.

Figure(6): A close up image showing the mess caused by Mangkhut in a skyscraper

Besides the physical damage to offices by the strong winds, the limited transportation after Mangkhut is another factor that builds on to the indirect losses of the businesses. Predicting the huge impact of typhoon Mangkhut, the Hongkong government issued the suspension of school the next Monday, but not the suspension of businesses. After the passage of Mangkhut, HKO reported that “Sea, land, and air transportation services were paralyzed on the day Mangkhut battered Hongkong. Owing to fallen trees and flooding, parts of the major roads were still closed and public transports could not be fully resumed the next day” (HKO, 2018). Hongkong has a comprehensive and convenient public transportation system that includes buses, MTR rails, trams, and ferries. Most residents in Hongkong rely on public transporting as means to commute. As gathered by the Transport Department Hongkong, the average daily public transport patronage is skyrocketing 12,562,000 during September 2018 (Transport Department, 2018). Yet, most public transportation was halted for a day after Mangkhut has passed, including the majority of bus routes, some MTR rails, and most ferries (HKO, 2018). The next Monday morning, thousands of

Hongkong citizens were crowding at the few operating rail stations to get to work. At 10 am, people at some stations were denied access to train platforms to void overcrowding(Cheng, 2018). Though businesses were asked to be restored, it is difficult for most businesses to operate as pre-Mangkhut given the poor condition of transportation.

Figure(7): Hongkong citizens rushes into MTR after buses were suspended after Mangkhut

Apart from the fact that employees couldn't arrive at the workplace safely and punctually, companies could not resume business given there might be damages to their properties. Small businesses such as local groceries and service-providing stores were struggling to maintain sustainable revenue as well. This is partly due to the loss of properties during the storm surge and partly due to the lack of customers since the transportation was cut off. Larger businesses such as malls and supermarkets were also struggling to refill stocks as few providers were able to deliver. Most businesses were unable to immediately recover from the trauma, and Hongkong's economy as a whole was unable to restore its full state after Mangkhut.

Figure(8): A fallen tree brought traffic to a stand still the day after Mangkhut.

The tourism industry was also undermined by the destructive impact of typhoon Mangkhut. Tourism is one of the most important industries in Hongkong, as noted in GovHk Fact sheets: “the tourism industry is one of the major pillars of the economy of Hongkong. In 2018, it contributed to around 4.5% of Hongkong’s GDP and employed around 257 000 persons, accounting for about 6.6% of total employment” (GovHK, 2021). Therefore, the reduction of travelers in Hongkong presents an issue not to be neglected. In September 2018, when typhoon Mangkhut passed, the number of international traveler arrivals (including Mainland China) was around 4.7 million (CSD, 2021). Compared with 5.4 million international visits in July 2018, 5.9 million visits in August 2018, and 5.9 million visits in October 2018, the number of international traveler arrivals in Hongkong has diminished by around 1 million. The tourism industry is a generality that includes more specific areas such as the food industry, hotel industry, services industry, and transportation industry, etc. Hence, a sharp decrease in travelers caused immeasurable economic losses in

numerous fields. As calculated by the Census and Statistics Department, the total expenditure of overnight visitors was HK$ 193,551 million in 2018 (CSD, 2020). Given the total number of international traveler arrivals in 2018, the average expenditure of one overnight traveler arrival is around HK$ 2986. With a reduction of 1 million arrivals in the month Mangkhut hit Hongkong, the rough estimation of indirect losses in tourism is HK$ 2,986 million.

Figure(9): People walking in a flooded mall. Shops and restaurants were closed.

After Typhoon Mangkhut, restaurants were closed, transportation was suspended, streets were flooded, amusement sites went under maintenance, making the city less attractive to visitors. Ocean Park, for example, is a renowned amusement park and a site of attraction in Hongkong. It was so seriously impacted by typhoon Mangkhut that the maintenance and repair expenses raised the operating costs by 14 percent (Tsang, 2019). Some streets, as shown in figure(10), were soaked in water. Besides the unpicturesque scenery and closed attractions, the unavoidable cancellation of flights, ferries, border-crossing buses during and after typhoon Mangkhut

contributed to the decline of visitors. 889 flights were canceled at Hong Kong International Airport and all sea transportation was canceled (HKO, 2018). Road border-crossing services from mainland China to Hongkong were limited. As mentioned earlier, there were 4.7million international arrivals to Hongkong during September 2018. The preponderance of them, 3.7 million, are traveler arrivals from mainland China. Moreover, among the 65 million visitors arrivals throughout 2018, up to 43 million of them, or 66% of total arrivals, were arrivals from mainland China through road transport (CSD, 2020). The statistics conclude two facts: 1) mainland China is the dominant source of tourism. 2) The major way for travelers from mainland China to enter Hongkong is by land. As touched on earlier, Hongkong is located to the south of Guangdong, mainland China, and is connected to it by road. As typhoon Mangkhut wiped through Hongkong, it caused equivalently disastrous destruction in Guangdong, which is the only entrance to Hongkong by land. Therefore, most mainland visitors were unable to travel to Hongkong given the devastating aftermath of Mangkhut. As collected by the Census and Statistics Department, mainland China visitors' expenditure is the highest among all other visitors, consisting up to 72% of total consumption expenditure for overnight arrivals in 2018 (CSD, 2020). Consequently, the deduction of a crucial source of tourism income leads to great economic losses in Hongkong.

Though tourism quickly restored to pre-Mangkhut level in the next month, the unrecoverable economic losses for an extended amount of time after Mangkhut ravaged Hongkong is a significant component of the total indirect losses.

4. Conclusion

Typhoon Mangkhut, as one of the most powerful tropical cyclones in 2018, deeply traumatized Hongkong and caused tremendous economic losses. Taking into consideration all public facility damages and private properties losses, the storm caused around HK$ 4.6 billion direct economic losses. This substantial financial impact is mainly due to the destructive nature of Typhoon Mangkhut and the high vulnerability of Hongkong. Likewise, the indirect economic loss is as well significant. Considering the impact on businesses, transportation, and tourism, the indirect loss is an immeasurable yet important aspect of the total economic losses.

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