ITECH 7415 – MTECH PROJECT

Dashboard Depicting Floods in India

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Introduction

Flooding is a natural event that causes significant impacts on the economy, mortality, lives, and infrastructure in India. Flood remains one of the main threats from past civilizations to the recent modern technological world(Sahay & Srivastava, 2014). The magnitude and frequency of the flood have been increased in recent years, which is mainly attributed to natural resources exploration, global warming, appropriate land use, and rapid urbanization. In India, most of the lands are flood hazards. The flood-prone areas increase by about 0.014 million hectares per year(Ding & Wang, 2009). This increase pushed many damages towards the farming, gardening, human and animal mortalities and lives threats. Every year the intensity of the rains increased in India. Due to heavy rains, there are high chances of floods in different states of India(Dhar & Nandargi, 2003). The flooding problems increase the number of deaths and displacements of humans and animals. Due to the heavy flood, many states where foods and other living things affected or completely disappeared. These Floods are a risk for both the government and each state administration as they increase casualties. The increasing risks for states and peoples call for some initiative to be taken in this regard. The project aims at creating a dashboard that will predict the floods and suggest necessary measurements in response to the floods. The dashboard is interactive and provides complete detail to get the actual reasons behind the floods(Rafiq, Ahmed, Ahmad, Khan, & Research, 2016).

Problem Statement

Among the main issues faced by states and cities in India, Floods are the most prevailing issues. Due to heavy rains in India, floods frequently happen in multiple states India. Different states are affected by mortality, deaths, food waste, displaced persons, injuries to humans and animals, and future forecasts. Flood predictions are the main context of the problem that we needed to solve in this product. The problem is not simple to solve. Floods in India always act in disasters and affect humans and animals. The main reason for the floods is the heavy rains in the moon soon season. Although there are some necessary arrangements to control the flow of the floods, there are some other necessary measurements needed to take from the govt—side to manage all these matters. The initiatives must be taken to prevent from all these sides.

Vision and Mission Statement

The project is about Floods in India, and the vision of the project is to evaluate the trends of floods in Indian states. For this, a dashboard is needed to be formed to compare the floods that

occurred in various states. Also, various parameters such as its impact on human or animal life, economy etc., will be covered. We will create the dashboard by using the Power BI tool more appropriately according to our client's requirements. Besides, we will also predict the damage caused by future floods or what Change will occur in future floods. Moreover, according to the analysis of our visuals, we will provide recommendations on how we can protect human and animal life during floods.

The main target of our project is to analyze the data of floods that occurred in Indian history. Thus, providing the visualization through Power BI helps us understand the impacts of floods on human and animal life. Along with this, the significant impacts of floods on other parameters can also be visualized, such as economy, environment, the destruction caused to housing infrastructure etc.

Project Scope

The project team needs to construct a dashboard for visualization and predict future floods in India. The data should be collected from the last ten years in raw form, extraction, cleaning and looking for the attributes to compare the data. The dashboard allows the client and users to predict the floods in India and provide complete detail to show the effective results(Rakhecha, 2002).

Project Stakeholders

The best definition of the stakeholders is "Organization and Peoples who directly or indirectly in the project execution with positive and negative impacts for project success." In the project execution, the stakeholders are the main influences and play an important role(Derakhshan, Turner, & Mancini, 2019). The involvement of the stakeholders is dependent on the project activities. The main stakeholders of the "Depicting Floods in India" project are illustrated in the below table.

Table 1: Project Stakeholders Metrix

Names	Roles	Duties
ABC-1	Project Sponsor	● The project sponsor is the main person who initiates the project.

		● ● Always available to get feedback regarding all the project tasks. ● Keep in touch with the Project client and project team. ● Regular project backup and effectiveness.
ABC-2	Client	● The client is the actual investor of the project. ● Approve all the project tasks before execution. ● Execute the project according to acceptance criteria.
ABC-3	Project Supervisor	● Take the project from clients and hand it over to the project team. ● Regular contact with the project team to check the project progress. ● Recommend the main project changes and project effectiveness. ● Assign project resources to the project team.
ABC-4	Project Manager	● Make a project team and assign them roles of project. ● Monitor the working of the whole project team and collaborate in case of any issues or guidelines required. ● Schedule meetings regularly among project stakeholders to regularly update them on a project's progress. ● Effectively handle all the project files and documentation using social and electronic sources.
ABC-5	Data Analyst	● Responsible to Collect data, check data, clean data, and present data to the Power BI designer for the final product.

		• Use tools to interpreted data.
ABC-6	Researcher	• Research recent articles, magazines, new blogs and other articles on floods and their impacts on India. • Plan the work based on the project requirements. • Research and present the project methodology applied in the project. • Help the BI designer design the interactive dashboard.
ABC-7	Dashboard Designer	• Responsible for selecting the power BI tool as product dashboard design. • Load data, clean, and access data through power BI. • Develop user friendly and easy to explore dashboard. • Design and implement the data analytics and power BI dashboard design tools. • Present the final product to the project team as a complete solution.

Project User Stories

The user stories are part of the project. User stories are accomplished from Scrum methodology(Castillo-Barrera, Amador-Garcia, Pérez-González, Martinez-Perez, & Torres-Reyes, 2018). The working of scrum methodology is to create the user stories and design power BI visualizations for the project. User stories are the actual project client requirements that need to fulfill to achieve the project goals. All the user stories must accomplish to achieve project goals. User stories used in the project are described in below table 2.

Table 2: User Stories and Acceptance Criteria

Code	User-Story	Acceptance Criteria Mentioned

US-01	As a project manager, I can view the number of districts in each state is affected by floods	● As it is already established that the dashboard that will be designed will be very interactive. ● The project manager can easily search states to explore more depth knowledge. ● Inside every state, we explore the districts which are badly affected by floods.
US-02	As a data researcher, I need to view causes of floods and want to view which cause affected most of the time in different years(year can be selected by slicer)	● Causes of floods can be explored after apply different filter features in the dashboard. ● The pie chart is feasible to display the visualization. ● Since the user can filter through a selected flood-caused list in the visualization, the information can be obtained inefficiently.
US-03	as a data manager, I will analyze the top 10 states that are worst affected by floods.	● The visualization shows the top ten districts from India causes badly affected due to floods. ● The pie chart shows the affected states with a percentage of values affected. ● Individual states can also be searched for statewide recovery of options. ● The state's names must be written in order of affective values to sort the information easily.
US-04	As a client, I will view different states affected by flood maximum number of days or duration by different flood causes.	● The flood durations in the form of days are shown through the provided visualization.

		● Users can select the single state affected due to flood and the days for which floods have appeared. ● This dashboard will also give detail of the duration of flood with states. ● The days must be present in numbers against every flood cause through a pie chart.
US-05	As a project manager, I can view the number of human Fatalities by each state.	● Human fatality helps to understand the states where a lot of work needed to overcome the fatality. ● You can also access the statistics through the dashboard. ● The pie chart shows the adequate and relevant information related to the states. ● The percentage of deaths is also shown in the relevant state to show the complete analysis of the system.
US-06	As a project manager, I can view the number of Animal Fatality by each state.	● Open dashboard ● Check visualization where animal fatality is shown. ● The fatality shows the complete state-wise information in the form pie chart. ● The pie chart shows complete and relevant information related to the fatality. ● The data will help us understand all the animal fatalities in different states of India.

US-07	As a data manager, I will analyze the top states that are worst by displaced persons during the flood.	● A bubble chart also helps to indicate the values through bubble size with the state name. ● Since I am a data manager, I would want a report that shows all states where displaced persons encountered floods. ● The bubbles indicate the names of the states where displaced persons encounter most. ● The bubbles must contain the names of the states.
US-08	As a Project Manager, I am going to view different states by the number of human injuries.	● The dashboard must contain the names of the states where human injuries were found. ● Users will be able to access information based on different states. ● A treemap chart should display the states because of every box's treemap chart size. ● The total injuries must be written in numeric form so that every state should collaborate on the corresponding matter.
US-09	As a BI Designer, I want to view Fatality and Injuries Comparison by Different years.	● The comparison must be through a line chart with years on the horizontal axis and the number of injuries on the vertical axis. ● The dashboard must contain the comparison of the animal and human fatality.

		● The human injuries are shown and compared with the fatality. ● Area chart should be used to display the state's fatality and injuries comparison. ● The total injuries must be written in numeric form along the vertical axis.
US-10	As a project manager, I can view the average number of human Fatalities by each state and district using the drop-down menu.	● A Drop-down menu is required to change the states and districts. ● For every state year-wise human fatalities can be visualized. ● The bar chart is feasible to display the fatalities in numbers against the years. ● The dashboard should be interactive and fast, i.e., users can easily predict the desired results.
US-11	As a project manager, I can See future predictions and forecasting related to floods by using previous years' data.	● Clients' and stakeholders' requirements are fulfilled through the dashboard. ● User-friendly dashboard with line chart with past, current and future predictions. ● The future line should show the future forecast for the management. ● All the information is accessible by the user to show the relevant information.
US-12	As a data manager, I will analyze the total lost in the last three years during the flood.	● The pie chart is feasible to visualize information both in numbers and percentages. ● The last three years' information should be displayed with loss in the last few years.

		• The percent and numeric values show the loss due to floods.
US-13	As a User, I want to know about the Location of flood states and districts on the map.	• This user story should be visualized through geo-map because the geo map shows compelling detail to visualize all these matters. • On the India map, the bubbles show the flood states and districts. • Additionally, the size of the bubble shows the disasters that flood impact on state and district.

Project Objectives

India faces a lot of damage due to floods every year. The floods in India destroy the infrastructure, cause deaths, cause injuries, displacement, and economical damages. To overcome and provide sufficient detail, we design a significantly controlled dashboard to provide efficient knowledge on floods in India. The main objectives are.

- An efficient BI dashboard to predict Floods' knowledge in India and the dashboard shows statistical knowledge to predict the loss due to floods easily.
- The floods took many things and damaged the lands and agriculture, and we should analyze that the project should reflect sufficient detail to provide statistical calculation about such damages.
- Human and Animal fatalities are at the peak on flood days, so the project should detail the fatality positions and provide the efficient detail to show the project dependency.
- The state-wise knowledge about the damages should be helpful to make necessary arrangements to secure the highly affected states.
- Comparison of last few years loss helps to understand the total loss by flood in last ten years.

Requirements

The main project requirements are:

- Must follow the scrum methodology using sprints and backlog creations.
- All the project methodology work should be managed through Gantt Chart.
- A dashboard that shows the interactive Power BI visualization against every user story.
- The dashboard should provide flood predictions in India: Through the dashboard, the flood-relevant information in India should be helpful to organize the project requirements and project dependencies.
- The dashboard should be user-friendly to explore the project-relevant information effortlessly for the users and client.
- The project final recommendation report helps the project owners predict the project knowledge and provide details about the complete project activities.
- The dashboard will deliver the interactive dashboard that shows the mortality rates among humans and animals, year-wise mortality rates, the states where most damages occurred due to floods, human injuries in flood, floods forecasting by presenting the floods data.
- The recommendations should be provided at the end of the report to show the final project organizations and provide efficient detail about project requirements.
- The visualization requirements are based on user stories and their acceptance criteria.

Literature Review

Background

Floods are one of the most disruptive and destructive natural disasters in the world. During the past year, there has been an increased impact of climate change due to the irregular rainfall in many states of India. There, the incidents and danger of floods are increasing rapidly. In India, the total frequency of floods is about 50% of the total floods in Asia. It is among the most vulnerable countries to natural disasters due to its diversified range and unique range of natural features and the varied geo-climatic conditions. India has a particular geographical setting having floods in some parts during drought in others. In some areas, there is a hybrid state, and flood and drought existing at the same time. Due to this, it is highly prone to natural disasters like cyclones, earthquakes, droughts, and floods. From 1953 to 2017, the number of human lives lost

due to floods in India is 107487. The damage done to the crops and the areas is Rs1679.961 crore and 460.26 (in.m.ha), respectively. The total population that has been affected due to the floods in India is about 2058 million. In parts of Western and Southern India, floods are the worst nightmare. Valleys of Kerala, Maharashtra, and Karnataka were not considered flood-prone areas until recently, and now these are at risk. During the flood and land sliding of 2019, two villages were obliterated, leading to the cause of death of several people. In 2018 one of the worst floods in the history of Kerala occurred. In India, the uncertain climate change is causing very irregular and torrential rainfall leading to recurrent floods in the low laying areas. The population density of India is putting a more number of people at risk considering such circumstances (Kolvankar, 2019). Kolvankar (2019) distributed the areas of Indian Territory that are prone to flood in the following manner:

- The lower courses of rivers in the plains of North India change their courses due to silting. The areas that fall under this include Haryana, Delhi, Uttar Pradesh, West Bengal, Bihar, Himachal Pradesh, and Punjab.
- The Indus Tributaries include Jhelum, Beas, Ravi, Chenab, Sutlej. These lead to floods in Jammu Kashmir, Western Uttar Pradesh, Haryana, Himachal Pradesh, and Punjab.
- Some specific areas of Central India and the Peninsula get flooded by Narmada, Godavari, Krishna, Chambal, Pennar, and Cauveri.
- The areas along Eastern Cost are flooded due to heavy cyclone storms.

Flood Patterns and Factors Associated

Ray et al. presented the geomorphological and meteorological aspects associated with the four extreme floods in Uttarakhand in 2013, Srinagar in 2014, Chennai in 2015, and Gujarat in 2017. Results showed that all these floods occurred under varying environmental conditions and circumstances. The atmospheric regulations were different in all of these four areas from one and another. Moreover, the gambit for governance and policy planning is also totally different in these areas. The study clearly showed that extreme climatic events are bound to result in excess surface runoff leading to heavy floods. However, the response varies and is dependent upon the interaction of the affected habitat. In some regions, despite the heavy rainfall and flooding, the effect varies because of the geomorphological and meteorological factors and natural landscape encroachment. The rainfall produces hilly areas like Garhwal enhanced surface runoff. There it

affects only terraces with lower levels, and the higher level gradient confined meanders. This region is comparably more prone to the problems related to the slope. Srinagar suffers inundation due to the distinctive bowl-shaped geomorphology with the local natural outlets during heavy and extreme rainfall seasons. As it is a low relief and along the valley axis, it continues to remain a wetland. Other than this, one other major factor of the floods roots back to the indiscriminative encroachment and the rapid urbanization of different natural drainage pathways, which cause clogging, leading to spillover (Yang et al., 2012).

They were receiving heavy and concentrated rainfall in India. In it, almost 15cm rainfall might hit a single place in a day. In India, monsoon rains occur in the summer, and when the snow-fed rivers of the Himalayas already have water access because of the melting of the snow. Thus the capacity of the rivers is already reduced, and they are unable to accept more water from the rain. Due to this, areas where river velocity is rescued already, like North plains, are vulnerable to flood. Heavy rains cause a significant rise in the river volume, and thus, the river changes. This Change causes water to spill over the adjacent areas that cannot handle this water and drain it out, thus get loaded with water. Several parts of the Indian Eastern coast are prone to cyclones from October to November. These cyclones lead to low-pressure depression at the Bay of Bengal. Therefore this gets sucked at the deltas located along the Eastern Coast on Andhra Pradesh and Orissa. The strong wind and rain that occur due to cyclones cause heavy damages. The areas of Punjab and Haryana are prone to flood because of the inadequate and insufficient drainage system there.

Moreover, the vulnerability of the areas prone to flooding is increasing even further due to several other factors. Deforestation leading to soil erosion and silting of the river course. This reduces their capacity of absorbing the water, thus cause sill over. The factor is the primary concern for Himalayan Rivers. Silting significantly affects the Brahmaputra. Overgrazing also leads to increased floods as this leaves the soil without any cover, especially in foothills. This leads to the reason for the silting of the river courses. The hills of Himachal Pradesh, Uttarakhand, and Punjab are suffering majorly from this issue. Another primary reason that the studies have proved is the unscientific farming practice such as cultivation shifting causing loss of vegetation cover and soil erosion. This type of silting is more prominent in the North-Eastern part of India, where it is a significant cause of floods in the Brahmaputra River.

Ahmed, Pandey, & Kumar showed TRMM (Tropical Rainfall Measuring Mission) based assessment according to which the 2014 flood in Kashmir valley was due to anomalous accumulated rainfall from June to September 2014over the valley. That was intensely concentrated over the southwestern part of the valley due to heavy rainfall. The regional rainfall pattern showed that in the Southern hilly region, the high runoff because of the extreme rainfall accumulated and aggravated the inundation situation of the flood. Due to all this, the Dul Lake and Jhelum River water level raised, causing partial and complete submergence of different land cover. Moreover, this accumulated runoff got stuck in Wular Lake that increased its overflow, and resulted in the inundation of its areas. The results showed that the flood inundation in this valley was due to the excessive cumulative rainfall and various temporal shifts in the region's rainfall pattern (Ahmad, Pandey, Kumar, & Chemistry of the Earth, 2018).

In the mid of August 2018, the Central Kerala region of India faces the worst catastrophic flood during the southwest monsoon since 1924. This inundated the lowlands of Kuttanad and the highland parts at the Pathanamthitta. Due to this, various polders, natural and manufactured channels, and several cut-offs were filled with water. The reason behind this was the highly intense rainfall of 2018. The government of India declared it as the most severe and caused unprecedented loss and damage to several built-up areas, human population, and infrastructure. By September 2018, Kerala received an increased amount of rainfall, almost 24% than before. The 1 and 2 days' extreme precipitation conditions, along with the runoff scenarios, were way more than anything in the previous 60 years. The reservoirs there were already reached 90% of their storage capacity, and the heavy rainfall led to the opening of the spillways of different reservoirs. This added severe devastation. Other than this one, most primary factors of this flood include the related reservoir management. The unusual southwestern monsoon and the extreme rainfall increased the reservoir's water level more than the whole reservoir level among all the major dams in the Kerala river basin. This forced reservoirs' water through the flood gates, overflowing the dams, thus compromising the people's health and safety in the downstream areas. Before this, the SW monsoon rainfall already saturated the soil column to its limit. Both of these factors combined one after another led to full water logging in the low topographic, causing damage to the homes, roads, buildings, and other infrastructure (Vishnu et al., 2020).

Vazhuthi & Kumar depicted the metrological, hydrological, and human factors of the flood in India's tropical Country.

Metrological factors

The metrological factors include several climatic changes. Their rainfall is extreme due to monsoon and several other climatic factors. Moreover, global warming leads to extreme weather conditions and uncertain events. The increased precipitation and the ever-changing climate also play a huge role. For example, the Mumbai floods of 2006 and 2017, the data of IMD revealed that during the last century, there had been observed an increasing trend in the extreme rainfall all over the Indian subcontinents almost time times than before. This increased rainfall is linked to the Arabian Sea increased warming. This also causes changes in the Bay of Bengal that change the monsoon winds' pattern. Due to this, several cyclones happen to have high intensity. This leads to heavy rainfall lasting from 2 to 3 days, causing flash floods in the region. The climate simulation model showed that the rainfall is predicted to increase further y 20 to 30% in the next 60 years (Rafiq et al., 2016).

Hydrological Factors

The risk of flood increases when the surface runoff is greater than the perception infiltration rate. This depends on the soil type and the water-retaining capacity. Trees and the vegetation in an area reduce the water speed and help in percolation. This reduces the damages and losses. However, rapid urbanization is affecting the surface runoff as well as hydrology. In all this, topography also has a significant role. This assists the carrying out of the water from the urban areas. In every type of town, the typology and hydrology differ. The urban settlement is divided into three categories in India – coastal towns, hill towns, and landlocked towns (Ramachandra & Mujumdar, 2009).

Human Factors

Several human inventions have increased the risk of floods. Urbanization is one major factor that is reducing the percolation and increasing the surface runoff. Urbanization is, in other words, directly with the flood risks. Encroachment and increasing population also play a significant role in this and are directly linked to increased flood risks. Furthermore, illegal mining activities cause depletion of the river and lake's natural bed leading to soil erosion and reduced water retention capacity of water bodies. Other than this, some other major human factors depicted in the study include interference in the drainage systems, several tourism activities that are not

planned, unplanned, and improper release of water from the dams, and absence of a proper management framework and administrative policies (Pour, Abd Wahab, Shahid, Dewan, & Society, 2020).

Effect of Flood

Vazhuthi & Kumar showed that urban floods affect urban life in two ways- tangible and intangible losses. In the tangible losses, they further divided them into direct and indirect losses. Direct being the ones such as structural and building damages and Indirect being ones such as traffic disruption, emergency costs, and several economic losses and issues. Similarly, intangible losses are divided into direct and indirect losses. Direct losses include health effects, death and causalities, and several ecological losses. Indirect losses include the recovery process after the flood and mental health and trauma from which people go through(Gupta & Nair, 2011).

Mishra and Lilhare showed that among 18, only four river basins that include Brahmaputra, Narmada, Ganges, and South Coast are projected to face extreme streamflow in the monsoon season under RCP 4.5. However, the basins of Tapi and Mahi experience a downfall in streamflow during the same climatic scenario, but this links with it a substantial intermodal shaky the other hand only. On the other hand, on seven bases, namely the Godavari, Ganges, Mahanadi, Brahmani, Pennar, Narmada, and Subarnarekha, streamflow is predicted to increase under RCP 8.5 (Mishra, Lilhare, & Change, 2016).

Sudheer (2016), in his report, showed that in Narmada Basin, the flow for the Barmanghat gauging site might increase by only 5% from 2071 through 2099. This value varies between 404.7 cumecs to 610.3 cumecs, showing that during the end of the century 2071-2099, the events causing such extreme floods may increase even further (Sudheer, 2016). Das and Umamahesh (2018) showed that the annual monsoon flow is predicted to decrease during this time frame compared to the baseline period of the Wainganga River Basin. The study found that by the end of the 21st century, the projected monsoon flow is likely to decrease. Das et al. 2015 showed that by the end of the 21st century, the Northern Sierra Nevada discharges with a return period of fifty-year the larger floods are projected to increase by almost 30 to 90%. This value also depends on the climate model. However, in Southern Sierra, the flood rate might increase from 50 to 100% (Das & Nanduri, 2018). Asadieh and Krakauer (2017), in the study, showed that 37%

of the global land areas are projected to increase in high streamflow in the case of RCP under 8.5. This will have an average increase of almost 24.5%.

On the other hand, there will be a 43% decrease in streamflow of the global land areas. This might enhance the chances of drought in such regions. In this, the average decrease will be around 51.5% (Asadieh, Krakauer, & Sciences, 2017).

Various data is available on the impact of floods on the environment. It is pretty challenging to interpret that fatality data due to flood given extreme events and various temporal trends. Researches have shown that the most significant social demographic factors such as urbanization, population growth, usage of the land, growth of the population of a particular area, and disaster management and warning system highly influence these trends. In developing countries like India, many people die due to drowning in floodwater, and almost 539,811 deaths have occurred from 1980 to 2009, and this number keeps on increasing. In India, people being mainly on the motorcycle during the flood time, and the male member were highly associated with the mortality risk. Other than this, older and younger aged people also face an increase in mortality risk. However, the impact of floods on the human population in terms of injuries and mortality presents only a minimum estimate as the losses that occurred due to such floods are not adequately reported. The past data shows that floods have a significant toll compared to the other natural disasters on the human population. Also, the vulnerability of humans to heavy floods is increasing with time, and therefore the impact and frequency of effects of floods on human life are expected to increase in the coming future. This requires high-end policies for mitigation and preparedness so that this disaster can be handled efficiently and its impact can be reduced as much as possible.

Singh et al., in their study, showed the impact of the Kerala flood on the region and the biodiversity. Due to that flood, around 373 people died within 15 days until 22nd August 2018. This also led to the death of various livestock animals like buffalos, pigs, goats, cattle, and poultry. Due to this, all international and domestic flights were suspended until 26th August 2018 and caused colossal infrastructure loss and agriculture crops, farms, and ponds. Due to this, polluted water got mixed in the ground and various other natural water bodies making it unhealthy and toxic for drinking and household purposes. A report from CIFT (Central Institute of Fisheries Technologies) showed that this flood had caused losses in the livelihood of fishers of

around 93.72 crores. Schools, colleges, and other educational institutions closed due to the flood until the normalization of the situation (Singh, Singh, Supriya, & Singh, 2018). The flood of 2014 in the Kashmir Valley caused massive destruction in the agricultural fields. Dul Lake and the Wular Lake inundated a huge number of villages and other surrounding parts of the valley. Due to this, the capital Srinagar was inundated under 15 feet of the water by the flood. This heavily impacted the agricultural lands around 1389km2 and damaged the standing maize and rice crops to a very huge extent (Ahmad et al., 2018).

Flood Management

A developing country like India requires to take a balanced view of management and preservation. India has a long history regarding irrigation that continued at a low pace till partition. After the independence, it has been one of the topmost priorities of its government to control the food deficit of the Country and took a huge amount of measures for it included various medium to large river valley projects. The National water policy of India has proved to be good in terms of planning, management, and development of the water resources in India in a comprehensive manner. This can provide a potential for flood control in the Country. Currently, the figures show that a reasonable amount of protection has been provided to the areas that are prone to flood but all the flood protection and control strategies do not prove to be enough in the Country. There is still no complete solution being implemented. Flood embankments and flood cushions are proved to be good and provided a big relief to flood damage and the flood forecasting done by the Central Water Commission also played a huge role in the minimization of flood damage control and in saving human lives. However, despite the huge amount of effort and controlling measures by India the death toll and the socio-economic damage number are still high. No doubt that the process is very complicated due to its varying socio-hydro climatological factors such as sea level, climate change, and several other socio-economic dynamics. Researches have been conducted on the impact of measures but the results show that the traditional structures of such measures need improvement and policies and strategies might be in place but what is required most is the proper execution of those policies. There is a lack of proper management and faulty implementation of flood management practices (Mohanty, Mudgil, & Karmakar, 2020).

Conclusion Drawn from the Literature

The past literature and studies have shown that flood is considered as the most serious and recurring natural disaster especially in tropical countries like India. India has suffered more than any other country in Asia due to floods and it has impacted its economy, human population, and overall biodiversity. It has a drought condition in some parts of the Country while some areas are highly prone to flood. Most of the floods in India occur in the monsoon season around 79% of the total floods of the year and the number reaches its peak in the month of July. Plains of India like Maharashtra, Uttar Pradesh, Kerala, Kashmir Valley, and West Bengal have a greater risk of flood. Hill states such as Uttarakhand face catastrophic events causing the highest number of death rates in the Country. Recent studies have been conducted on the patterns and trends of floods in India and their depiction in those regions. The studies and research have predicted that the heavy rainfalls in India, especially the monsoon rainfall, are to be increased further instead of a decrease. Several testing methodologies exist to measure the severity of the flood and predict it timely. There is no single factor that contributes to the increased flood. It has different factors such as hydrological, metrological, geomorphological, and human factors. These floods are badly impacting the Indian population, economically and physically. A huge number of people died due to this and several got injured. Moreover, the agricultural lands got ruined affecting the income sources of farmers and many other people associated with all this. This also causes huge infrastructural destruction in the Country. It is clear from the past data that the climatic changes and increased rainfalls will continue to increase the flood risk therefore proper management and policies are required. In India policies are present but they lack proper implementation and strategy. In a developing country like India, it is really important that the government and the population are prepared in advance for such a disaster and should be to decrease the losses as much as possible.

Project Approach

Agile Scrum Project Approach

After discussing the project team and research, the Agile Scrum Project Approach is selected for the "Depicting Flood in India" project. Agile methodology allows the stakeholders to access the information regarding the project and its deliverables in the project. It allows keeping track of the project activities at any stage of the project. Scrum methodologies deliver the project in sprints. Sprints the project activities that involve the development and delivery of some part of the

project to the client. In this project, we divide the Scrum into three main sprints. Inside every sprint, we define project tasks(Khalid, Butt, Jamal, & Gochhait, 2020). All the project goals and objectives are achieved through this methodology. Inside the sprints, we assign priority to every task so that the priority tasks should be accomplished first and other tasks should be accomplished on the other stages. Agile Scrum helps the project team to deliver clients' requirements and timely achieve project goals. Based on the current methodology the agile is highly suitable for project management. All the project goals are set at the beginning of the execution of the scrum methodology(Srivastava, Bhardwaj, & Saraswat, 2017).

The whole project is divided into three sprints. In the first sprint, we cover four user stories, in the second sprint, we cover five user stories, and in the third sprint, we cover the four user stories.

Sprint 1

Sprint 1 takes eighteen days to complete all tasks. The main tasks covered in sprint one are shown in figure 1.

3. **Execution**	Whole group	14-Apr-2021	4-May-2021	20days
3.1 Sprint 1	Whole group	15-Apr-2021	3-May-2021	18days
3.2 Datasets uploading in Power BI	Amandeep Singh	16-Apr-2021	17-Apr-2021	1day
3.3 Cleaning datasets	Mandeep Singh	17-Apr-2021	18-Apr-2021	1day
3.4 Create dashboard	Amritpreet Kaur	18-Apr-2021	4-May-2021	16days
3.5 Making Visualizations on multiple states	Piyush kohli	19-Apr-2021	23-Apr-2021	4days
3.6 Visualizing main causes of floods	Amandeep Singh	19-Apr-2021	23-Apr-2021	4days
3.7 Visualization on duration of each flood	Mandeep Singh	19-Apr-2021	23-Apr-2021	4days
3.8 Visualizing number of affected districts	Amritpreet Kaur	20-Apr-2021	24-Apr-2021	4days
4. Sprint 2	Whole group	3-May-2021	22-May-2021	19days
4.1 Creating Dashboard	Whole group	4-May-2021	21-May-2021	16days

Figure 1: Tasks Covered in Sprint 1, 2, and 3

4.2 Visualization on human fatalities	Amandeep Singh	7-May-2021	11-May-2021	4days
4.2 Visualization on human injured	Mandeep Singh	9-May-2021	13-May-2021	4days
4.3 Visualization on number of people displaced	Amritpreet Kaur	10-May-2021	14-May-2021	4days
4.4 Visualization on animal fatalities	Piyush kohli	12-May-2021	16-May-2021	4days
5 Sprint 3	Whole group	22-May-2021	12-Jun-2021	20days
51 Create Dashboard	Whole group	23-May-2021	9-Jun-2021	16days
5.2 Visualization on revenue loss	Amandeep Singh	24-May-2021	28-May-2021	4days
5.3 Visualization on severity	Mandeep Singh	25-May-2021	29-May-2021	4days
5.4 Visualization on location	Amritpreet Kaur	26-May-2021	30-May-2021	4days
5.5 Visualization on budget spent	Piyush Kohli	27-May-2021	1-Jun-2021	4days
6. **Product**	Whole group	1-June-2021	7-Jun-2021	6days

Figure 2: Tasks Covered in Sprint 1, 2, and 3

The covered user stories in sprint 1 are:

User stories:

1. **Make visualization For No of Affected Districts by state wise**

As a project manager, I can view the number of districts in each state that are affected by floods.

2. **Causes Of Flood Different States of India**

In this user story, as a data researcher, I need to view causes of floods and want to view which cause affected most of the time in different years(year can be selected by slicer)

3. Top 10 Worst Flood Affected States By Duration OF flood

As a data manager, I am going to analyze the top 10 states that are worst affected by floods all the time

4. State-wise Flood Duration:

As a client, I am going to view different states that are affected by flood maximum number of days or duration by different flood causes

Sprint 2

Sprint 2 is most important because it covers five user stories from the project requirements. The complete sprints and their tasks are shown in Figures 1 and 2. The total time served on sprint 2 is 19 days. The main user stories covered in the sprint are.

User stories:

5. Human Fatality by each state

As a project manager, I can view the number of human Fatalities by each state.

6. Animal fatality by each state

As a project manager, I can view the number Animal Fatality by each state.

7. Top States By Displaced HUMAN during flood

As a data manager, I will analyze the top states that are worst by displaced persons during the flood.

8. Number of People Injured

As a Project Manager, I am going to view different states by several human injuries.

9. Fatality & Injuries Comparison by Different years

As a Project Manager, I will view Injuries and Fatality for humans and animals for different years.

Sprint 3

In Depicting Floods in India project, sprint three is covered in 20 days. The spirit tasks are shown in figure 2. It covered four user stories. This sprint is lengthy compared to sprint 1 and sprint 2 because it contains the end product report and project finalize activities. The sprint three covered user stories are:

User stories:

10. Average Human Fatality by each state

As a project manager, I can view the average number of human Fatalities by each state and district using a drop-down menu.

11. Future Forecast

As a project manager, I can See future predictions and forecasting related to floods by using previous years' data.

12. Total damage and loss during the flood in crore

As a data manager, I will analyze the total lost by the last three years during the flood.

13. Location of flood states and districts on the map

As a BI Designer, I want to view the states and districts through geo-map where flood is affected.

Project Methodology Tasks

As Agile Scrum methodology is selected as project execution. The Scrum is purely based on incremental development through project sprints. Each iteration consisted of more than two weeks of sprints. In every sprint, we develop important product features and deliver them to the client for final approval. The beauty of the scrum methodology is that it can add more features during the development of the sprints for stakeholders and customers' feedback stored. Scrum provides benefits for Complicated projects and result-oriented companies and projects(Cruz, Gonçalves, & Giacomo, 2019).

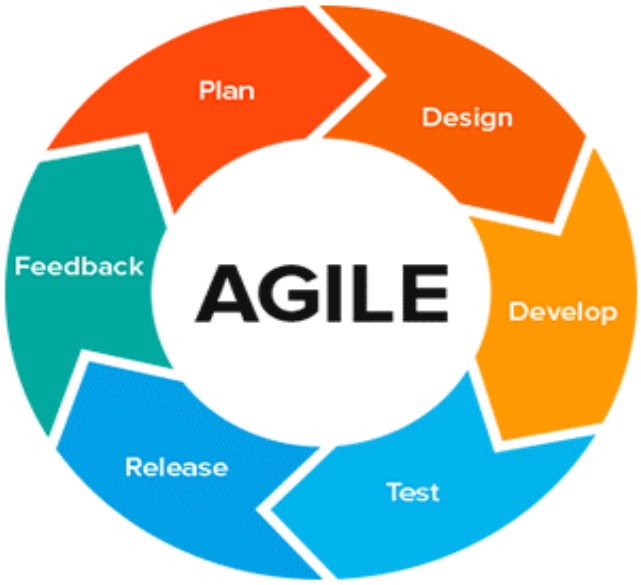

Figure 3: Agile Methodology steps followed in every sprint of the project.

Requirements: Every time before the planning phase, the requirements are mentioned. At the start of every sprint, the requirements are noted and mentioned against every sprint task. This phase is executed before every sprint execution to note all the stakeholder requirements and plan the whole sprint. In the visualization dashboard project, the client requirements are linked with the successful visualization of user stories. The main agile phases are.

Planning: The project plan is very necessary to smooth the execution of the project. The plan provides the layout of the actual product development and project activities execution. Planning involves the users, time, cost, and other similar resources to be ready for product development.

Design: The design phase helps to design the product dashboard according to the client and user expectations. All the critical thinking skills must be deployed to plan the system. The complete understanding and execution of the product are handled through the product dashboard activities. The design phase involves all visualization design and project activates design.

Development: The development of the end product is involved in this phase. The end product is the sprint dashboard. The development involves the power BI tool to load data, model data and then select appropriate graphs based on acceptance criteria to develop the product.

Testing: The product testing is based on user-friendliness and fulfills the user story acceptance criteria. The acceptance criteria should be needed to handle based on the provided user story. This involves test and removes any error or bug found in the product.

Release and Feedback: After successful testing, the product is released to the client for field use. The released product is error-free and ready to use in predicting floods in India.

After release, the feedback is provided by the client and another stakeholder for future references. Based on the feedback, the product can be improved in the future.

Product Discussion

A user-friendly and interactive dashboard is developed using the power BI tool for Depicting Floods in India project. The dashboard project aims to analyze the floods in India, causes of floods, and provide details about the disasters due to floods in India from different states and different districts. The dashboard should reflect useful information so that every dependent stakeholder of the project product can use the dashboard to predict the dashboard development effectively. This dashboard uses pie charts, bar graphs, geo maps, treemaps, line charts, and other charts to visualize the user stories' information. We have developed the dashboard in a very effective way to explore the knowledge about floods in India easily. During the dashboard development, the high priority is kept in mind: user-friendliness, interactive, and according to the acceptance criteria of the user stories.

The product is delivered in three sprints. Inside every sprint of the dashboard, we visualize 4, 5, 4 user stories consecutively. The dashboards for all three sprints are shown in Figures 3, 4, and 5. All the user stories are covered and tested in the product.

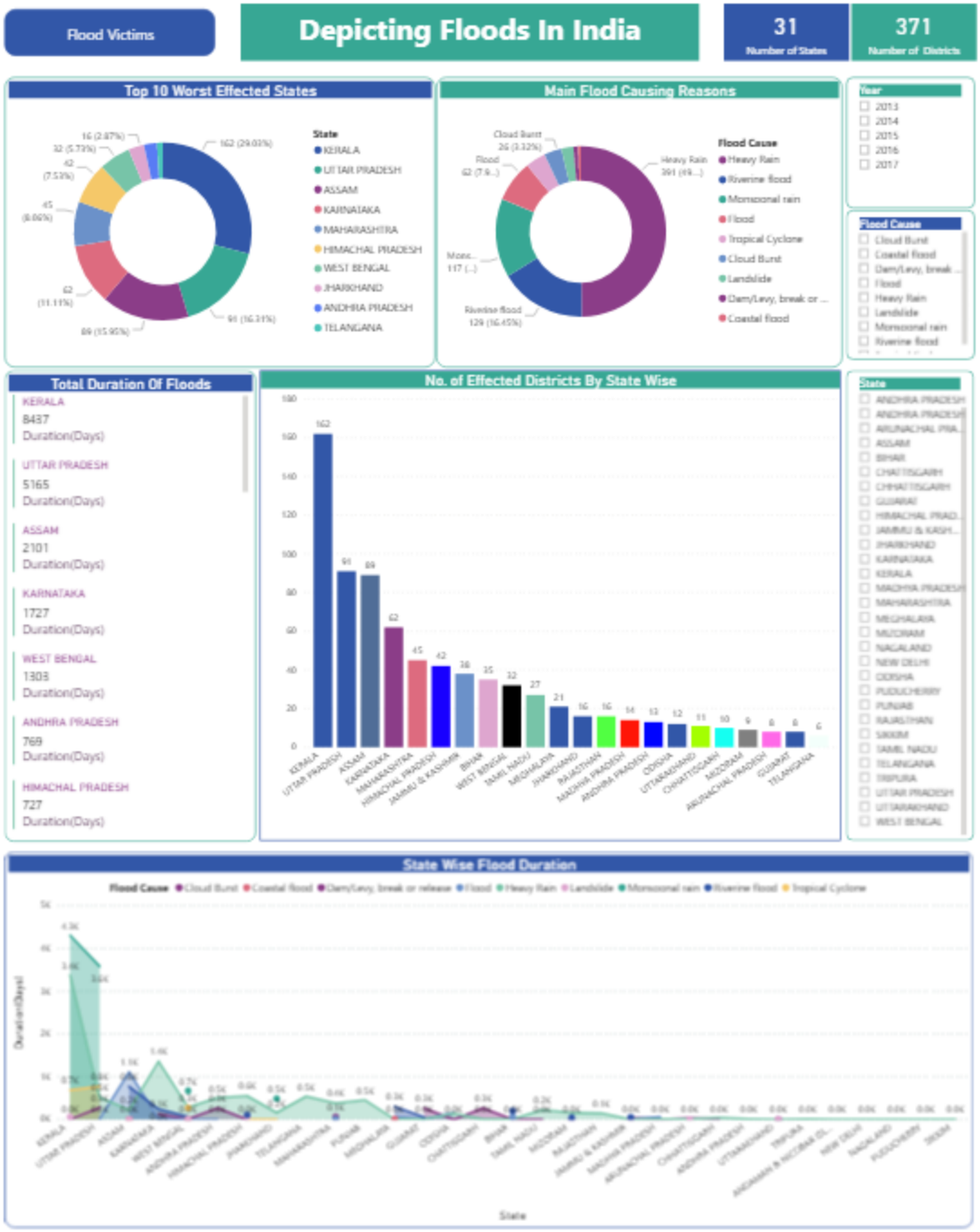

Figure 4: Sprint-1 Dashboard product

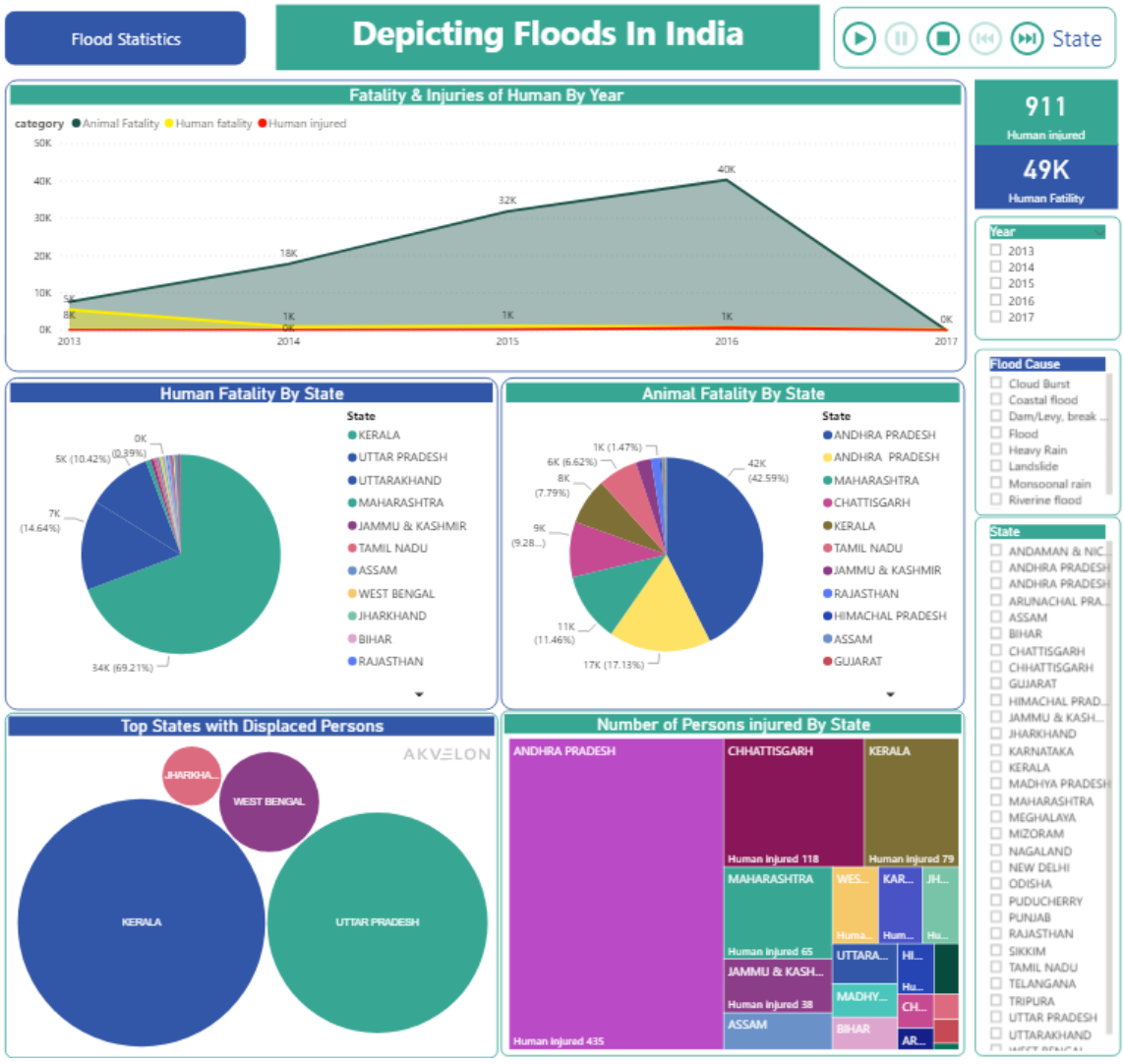

Figure 5: Sprint-2 Dashboard Product

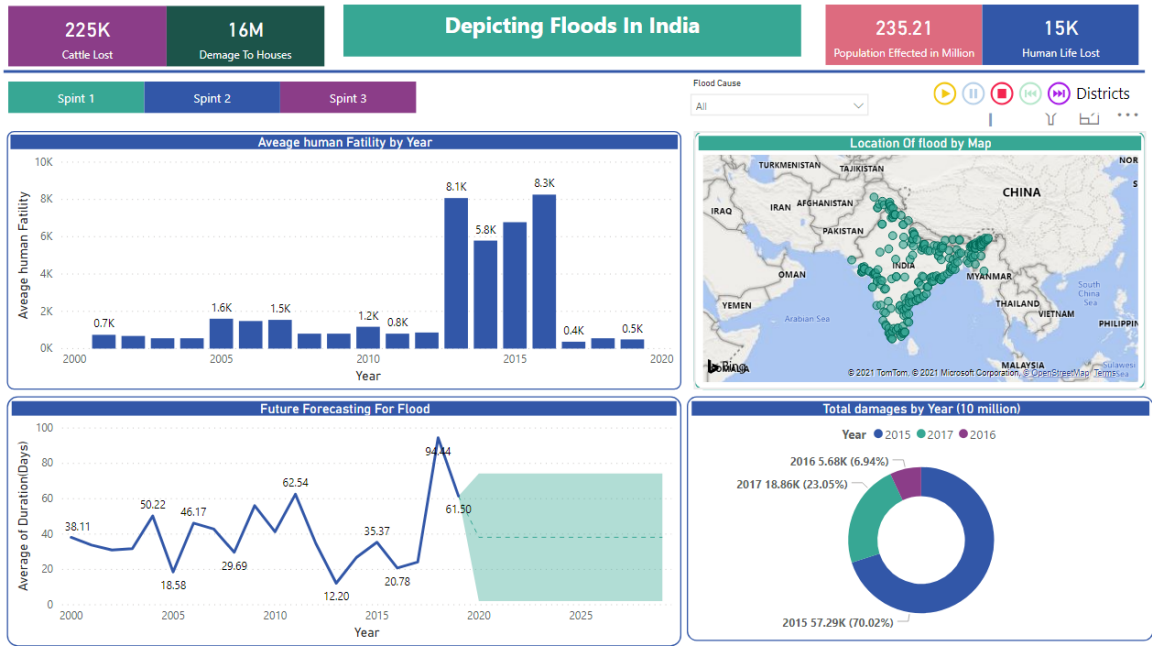

Figure 6: Sprint-3 dashboard product

In the next section of the report, all the user stories and their corresponding individual visualization are presented, tested, and discussed.

- As a project manager, I can view the number of districts in each state that are affected by floods so that broad visualization can be made.

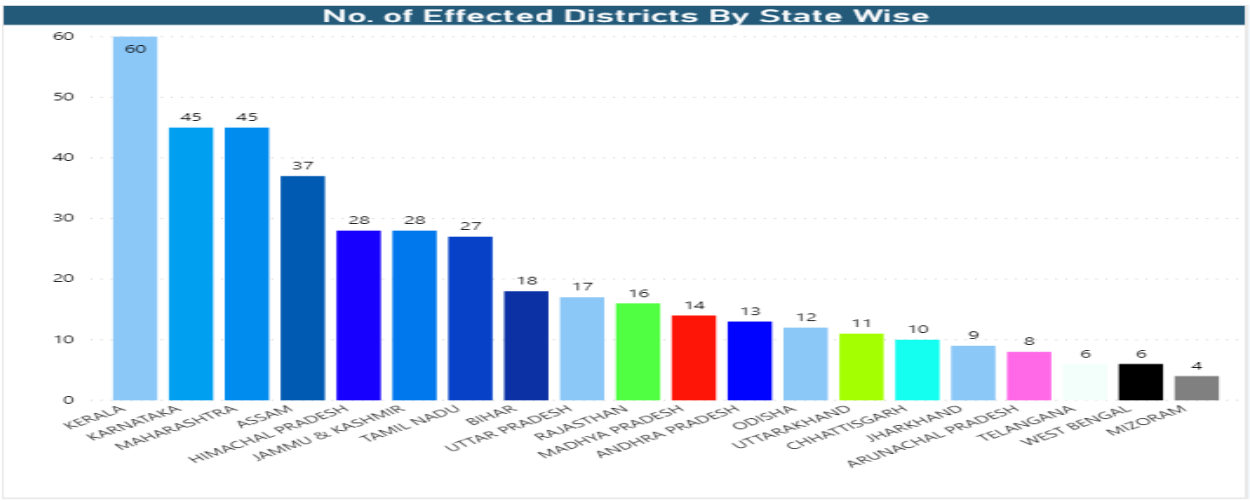

Figure 7: No of Affected Districts by state wise

The visualization shows in figure 6 the total number of districts showing the state-wise effects of the flood's attacks. According to the visualization, Kerala is the no. 1 district which effects highly due by floods. Karnataka stands on send and Maharashtra stands on third. Like these all-other districts and their effect rates are mentioned against each district. At last, Mizoram lightly effects due by the floods in India.

- As a data researcher, I need to view the causes of floods and view which cause affected most of the time in different years (year can be selected by slicer) so that I easily predict the cause of flood for future correspondence.

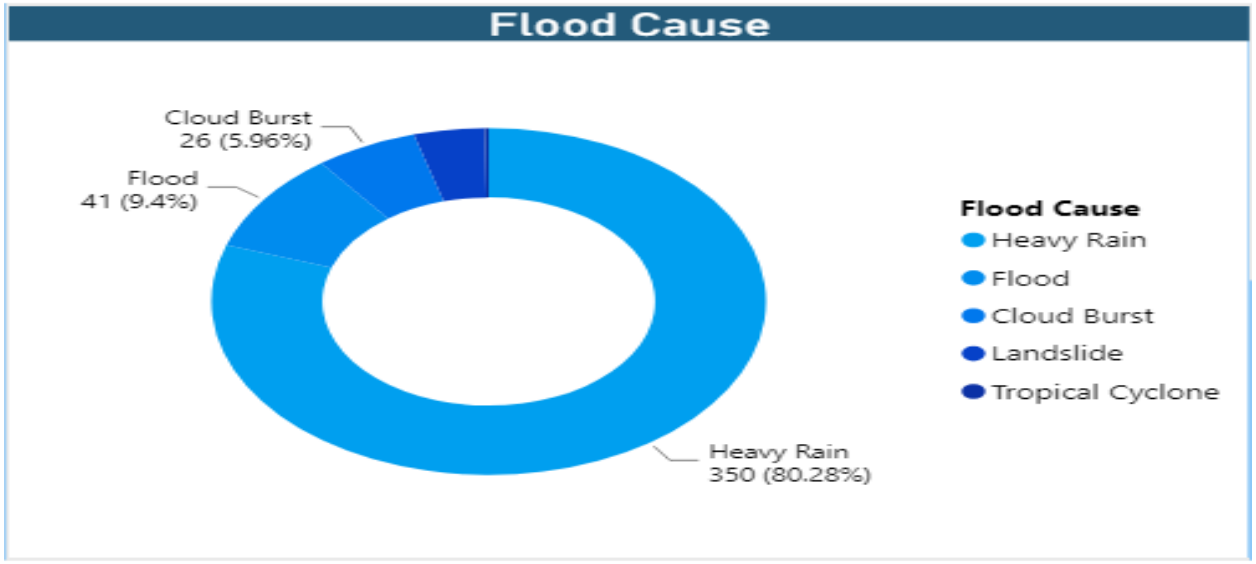

Figure 8: Causes of floods in India.

According to the visualization in figure 7, the user story two the main causes of the flood inside India are Heavy Rain by 80.28%, Flood 9.4%, Cloud Burst 5.96%. On the other hand, the Landslide and Tropical Cyclone also affect and cause the floods in India.

- As a data researcher, I will analyze the top 10 states that are worst affected by floods all the time, so that these states can be prioritized for assistance.

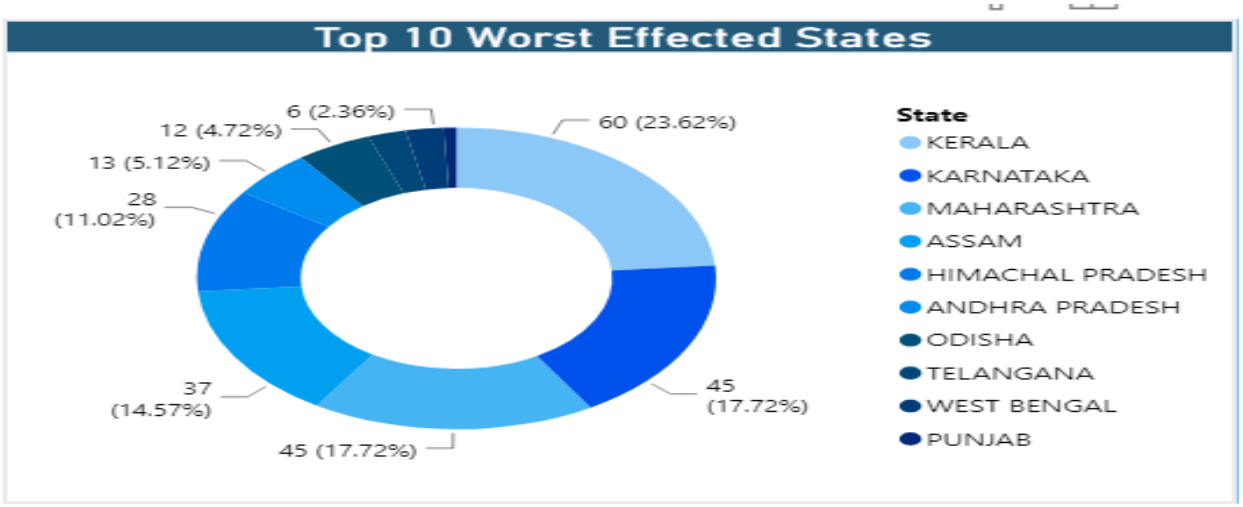

Figure 9: Top 10 affected states due to floods

User Story 3 Visualization for sprint-1 shows in figure 8 the top ten worst flood-affected states of India. The main states from the highest effect towards lower effect are Kerala, Karnataka, Maharashtra, Assam, Himachal Pradesh, Andhra Pradesh, Odisha, Telangana, West Bengal, and Punjab. These are the top 10 states where flood affects the most.

- As a Dashboard Designer, I need to view different states affected by flood maximum number of days or duration by different flood causes, so that states with large number of days can be put in risk.

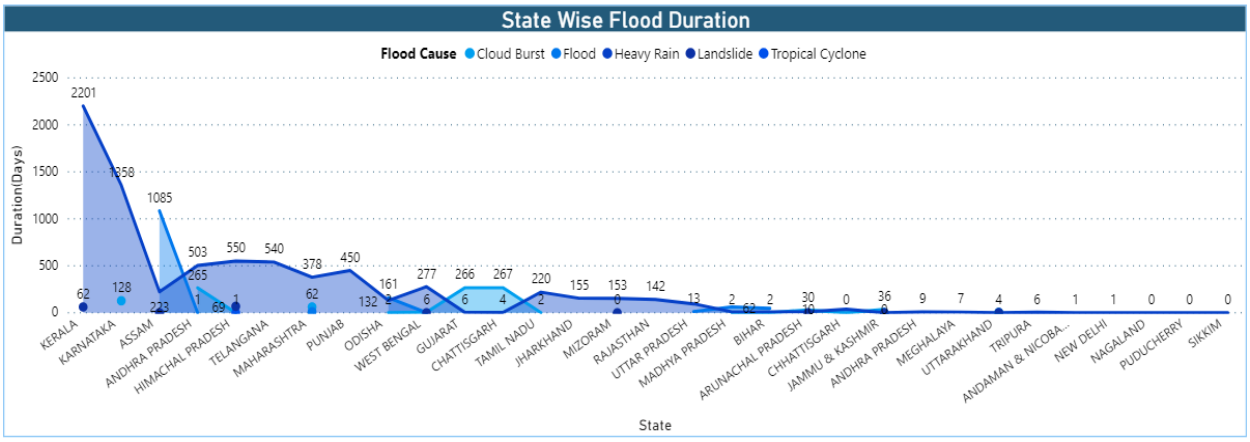

Figure 10: State-wise floods duration

This visualization shows that state-wise flood duration in days. Kerala shows the highest with Karnataka on second and Assam on third in flood days. All other districts show the number of days with a flood. On the other hand, the flood cause also shows with the district and the number of days for a flood.

- As a project manager, I can view the number of human Fatalities by each state, so that, financial assistance can be provided by government to those who lost their family members.

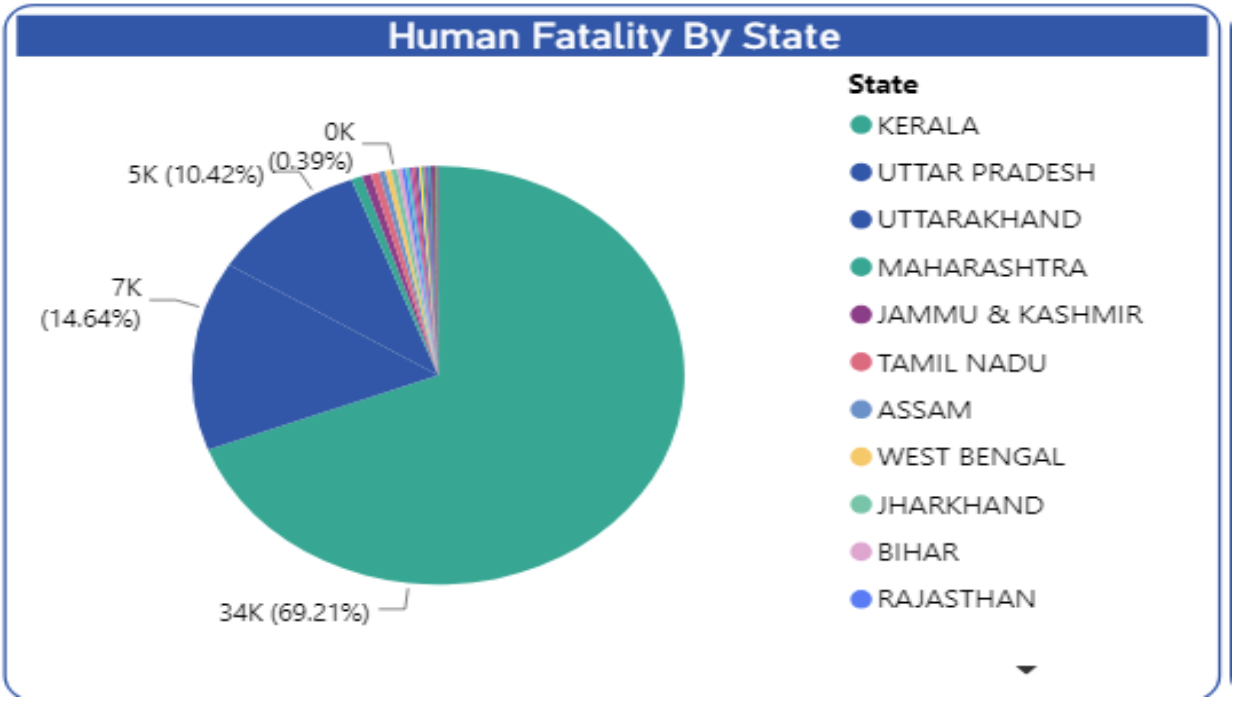

Figure 11: State-wise human fatality

The dashboard presents the fatality factor by every state. The visualization shows that Kerala shows the highest factor of 69.21%, Uttar Pradesh shows 14.64%, Uttarakhand shows 10.42%. Likewise, all other states show the fatality factor. States with the highest fatality factor are in more danger.

- As a data analyst, I can view the number Animal Fatality by each state, so that the impacts of floods on different species can be visualized and comparison of past and present trends of animal deaths can be done.

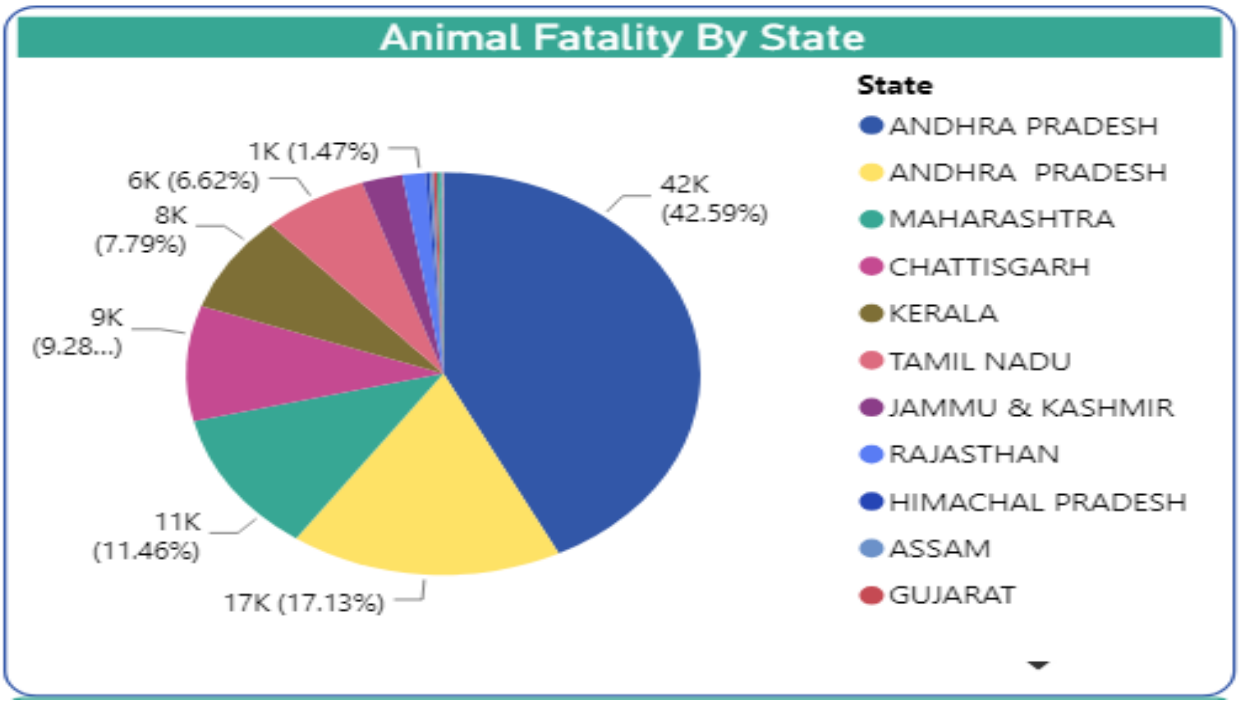

Figure 12: State-wise animal fatality

The dashboard presents the Animal fatality factor by every state. The visualization shows that Andhra Pradesh shows the highest factor of 42.59%, Uttar Pradesh shows 17.13%, Maharashtra shows 11.46%. Likewise, all other states show the fatality factor. States with the highest fatality factor are in more danger.

- As a data researcher, I will analyze top states that are worst by displaced persons during the flood, so that accommodation can be provided by local council.

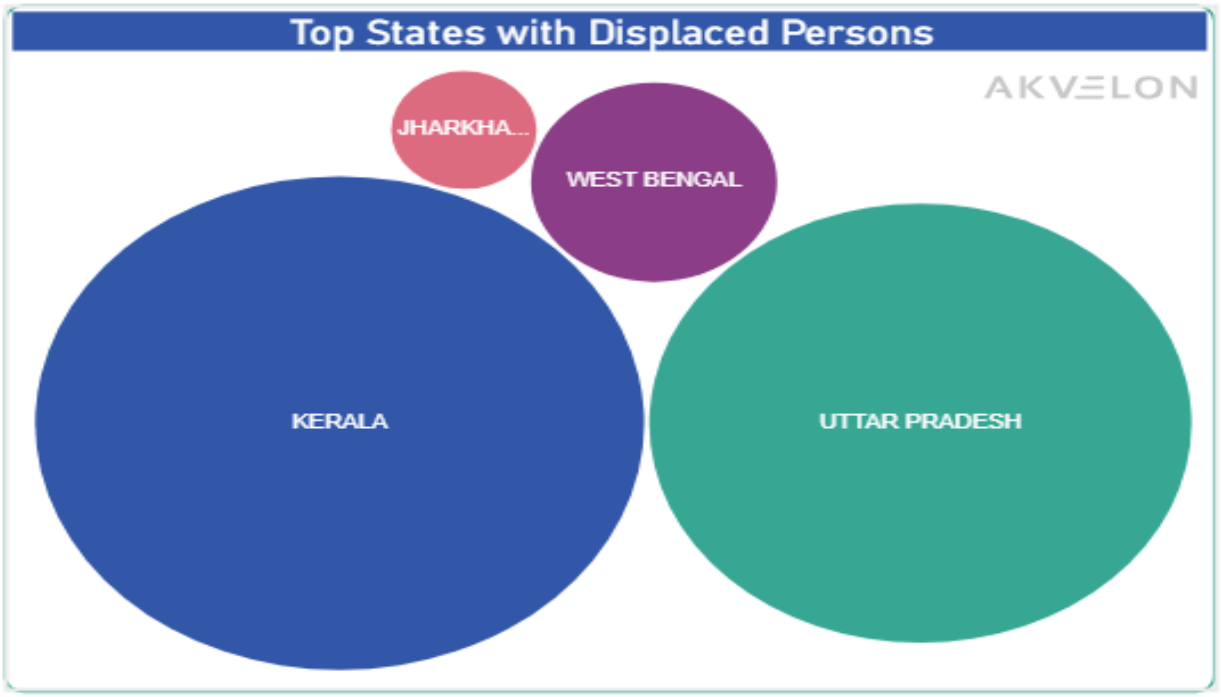

Figure 13: the Top States where most of the displaced person cases found

Due to floods, many of the persons were displaced to different other states. So, according to the visualization due to flood, the Kerala Persons are highly displaced, The Utter Pradesh shows on second highest with most persons displaced, West Pongal shows on third, and Jharkhand shows fourth-highest states where highest persons displaced.

- As a dashboard designer, I am going to view different states by the number of human injuries, so that medical assistance can be provided accordingly.

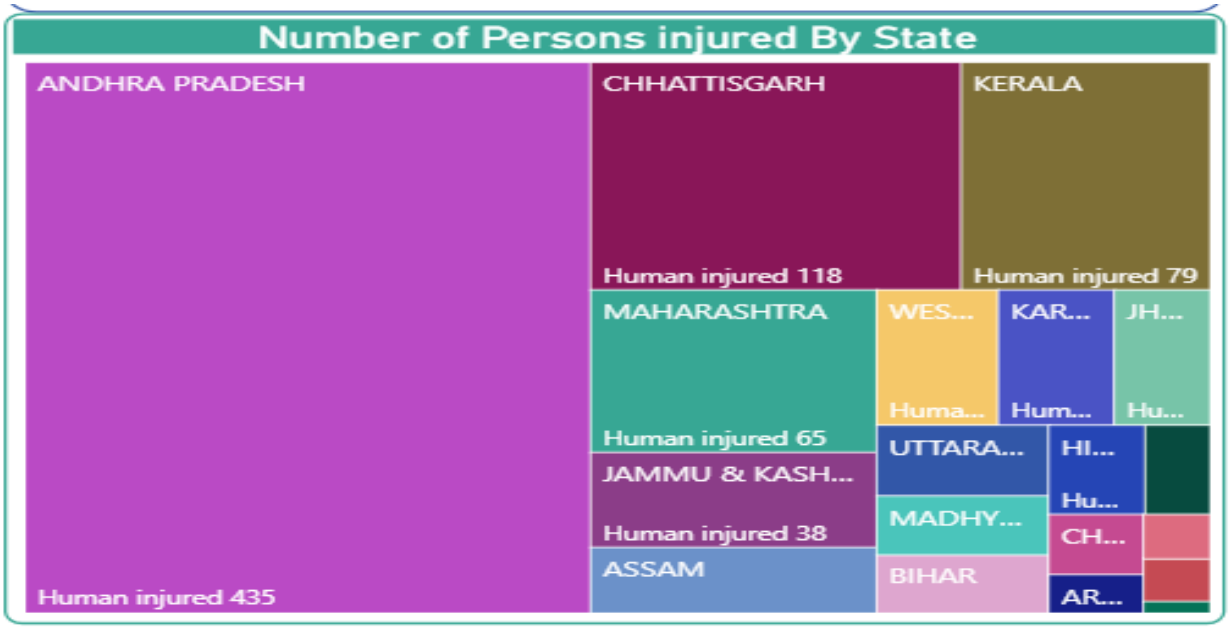

Figure 14: State-wise injured persons

This visualization shows the detail of the states where human injuries are found during the floods. The highest injuries state is Andhra Pradesh with 435 injuries detected, Chhattisgarh on second with 118, Kerala has 79, Maharashtra has 65, Jammu & Kashmir has 38, etc. Other states also have injuries due to floods.

- As a data manager, I am going to view Fatality & Injuries Comparison by Different years, so that in future correspondence medical facilities are provided.

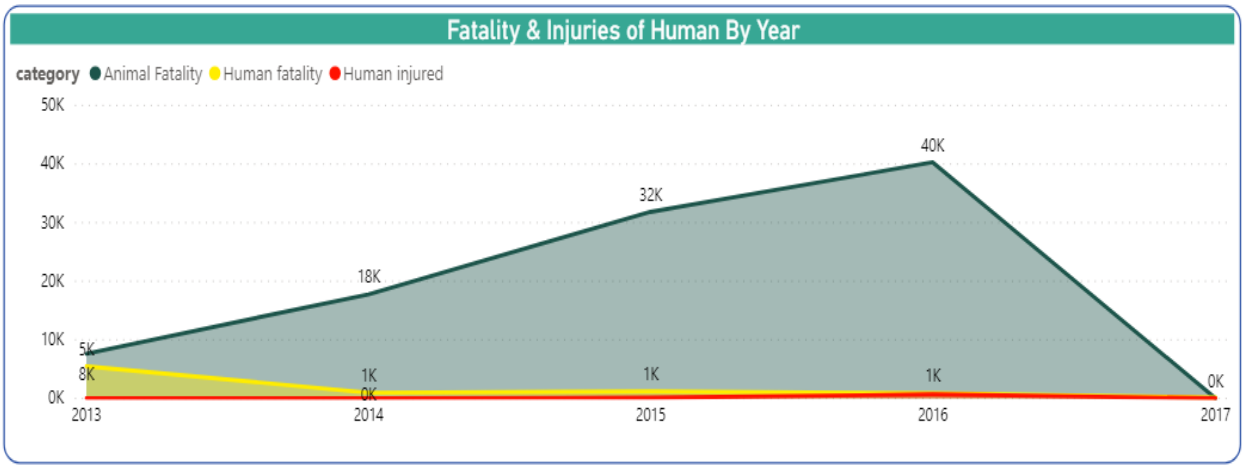

Figure 15: Human Fatalities and injured by years

According to different years like in 2013, the injuries due to floods are about 5k, in 2014 the injuries are about 18k, in 2015 the injuries are about 32k, in 2016 the injuries are about 40k. According to the analysis, the highest injuries found are in 2016, which shows the highest injuries.

- As a BI Designer, I can view average number of human fatalities by each states and districts using dropdown menu so that comparison of human deaths can be made in different states.

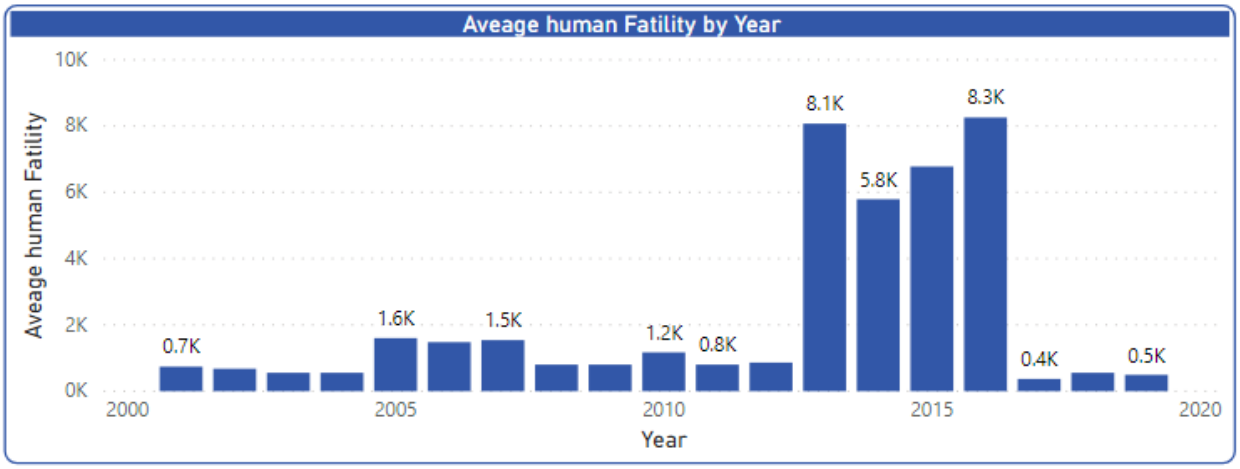

Figure 16: Average Human Fatality by Year

The dashboard shows the human fatality for every state year-wise. The graphs show that from 2000 to 2012, the human fatality rates are less than a maximum of 1.6k deaths in 2005. But suddenly, in the next four years, i.e., from 2013 to 2016, the death rates are high, like 8.1k, 5.8k, 6k, and 8.3k. After 2016 the mortality rate remains less and reach 0.5K maximum. All the measurements and arrangements show that the state government handled the mortality rates effectively in the last three years.

- As a data analyst, I can See future predictions and forecasting related to floods by using previous years' data , so that proper mitigation techniques can be taken to prevent the future floods.

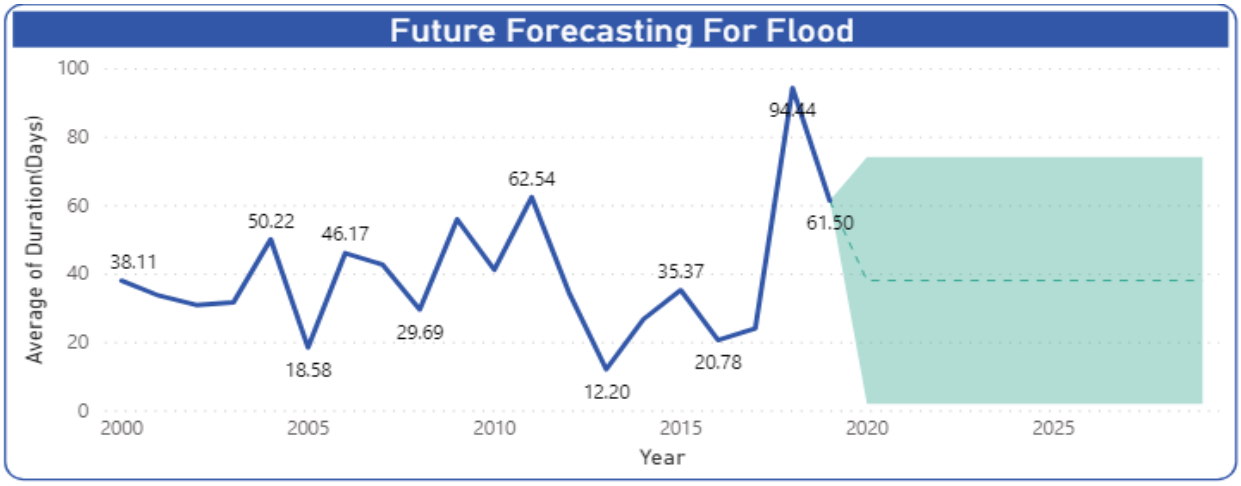

Figure 17: Future forecasting of floods in India

The future forecasting for the flood for different years is shown in the visualization. The future forecast shows that the next years' flood flows may encounter maximum flood flow in the different state by average days due to the last year's flood flows. There are chances that in 2021 or other future years, the floods can flow in more days than previous days.

- As a Project manager, I will analyze the total lost by the last three years during the flood, so that government can take better steps to improve the economy.

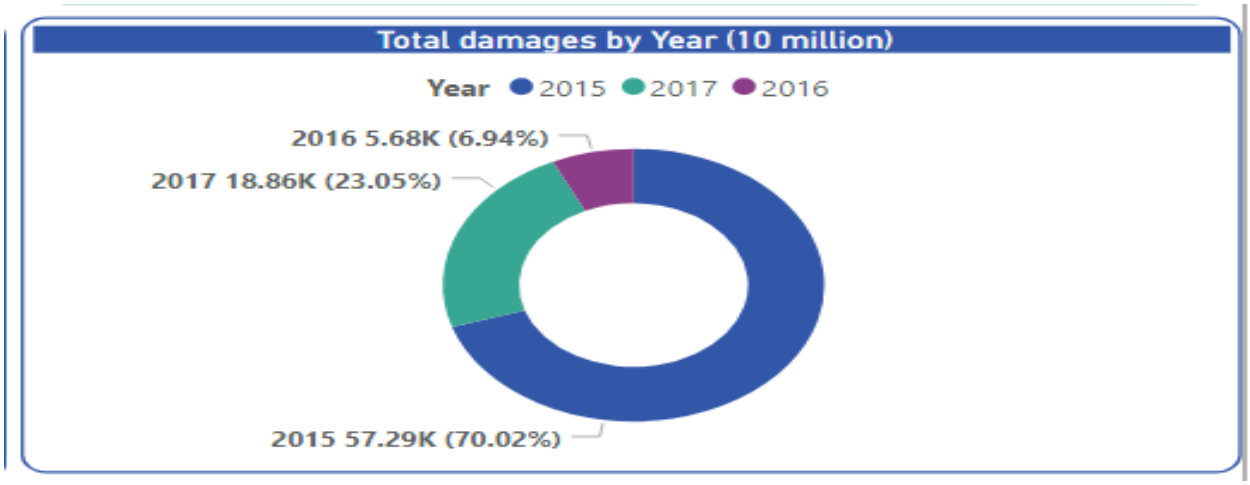

Figure 18: Three years total damage due to floods

The visualization shows that in 2015 the loss is maximum, i.e. 70%. In 2016 the loss decreased to 7%, and in 2017, the loss is about 23% of the total loss. The graph shows that 2015 is having the highest level of interpretation for the graphical representations.

- As a Data Researcher, I am want to view the Location of flood states and districts on the map.

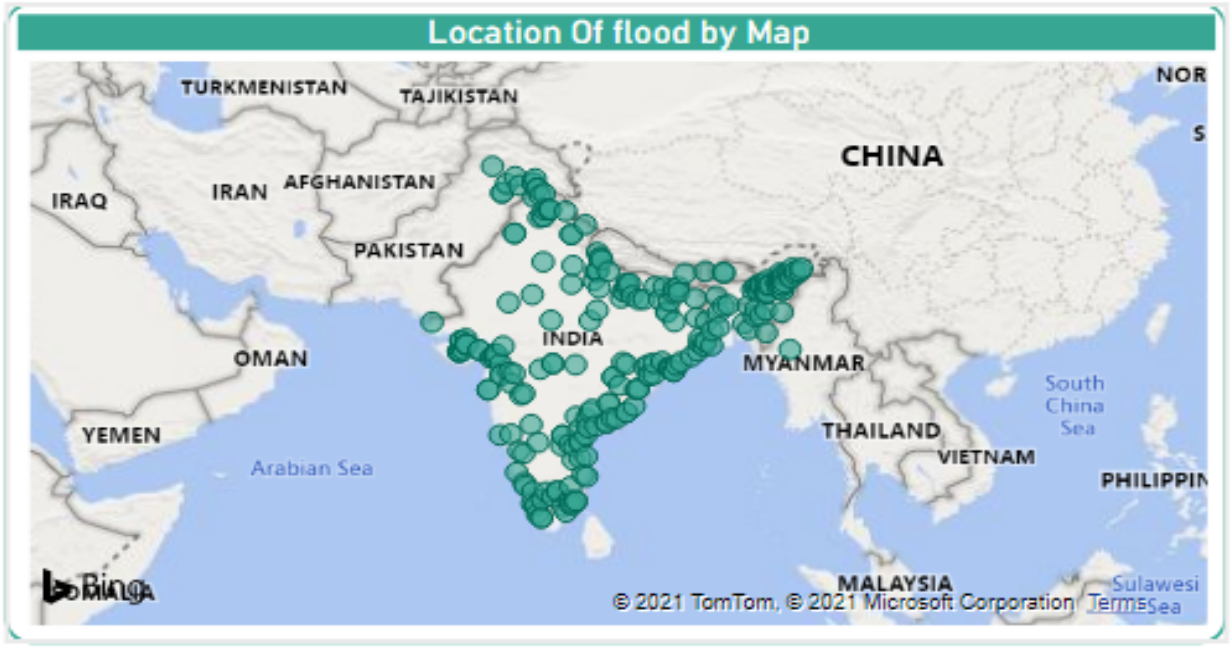

Figure 19: Location wise floods districts

Based on the bubble type visualization, the map shows that where the bubbles are maximum, the floods' encounters are maximum. One this is observed that all the states near the sea are badly affected due to floods.

Summary, Findings, Limitations and Recommendations

Summary

In India, floods prediction is one of the most important tasks to get completed because no one knows about the disasters due to floods every year. Year, mortality, misplacement, dangers wise knowledge is required to predict floods in India. The project's main idea is to collect information and data for floods in Indian states and districts and use the data to develop an interactive dashboard. The dashboard should be easy and user-friendly to predict the actual knowledge regarding floods and their impacts on India. The project is taken to complete analysis of floods,

their impacts on humans and animals, the disasters due to floods, the lands affected due to floods, and prediction of future floods. The dashboard can be used by drop-down and filtration options to participate in the flood's predictions effectively.

Findings

The main findings from the project are:

- Districts and states which are badly affected due to floods.
- The maximum and minimum time the floods remain in different states of India.
- Top states where floods enter and affect most.
- Human fatalities and animal fatalities due to floods in India.
- The name of the states where most of the persons were misplaced during floods.
- Number Human injured in every state of India.
- Year-wise comparison of the injuries in different states of India.
- Future floods were forecasting in the form of days.

Limitations

The main project limitations are.

- The total time of the project is less to find more useful information related to floods in India.
- The dashboard only predicts the floods and their impacts in India.
- The limited project resources can limit the usefulness of the project.
- As there are not huge datasets available on floods predictions in India, this product is limited to only found datasets.

Recommendations

- The govt. of India and the District government should target the highly impacted districts and make necessary arrangements for the humans, animals, crops, lands to save maximum damages.
- As there are different causes of the floods like rains, etc., the peoples should keep their necessary arrangements to safe from the floods in the rainy days.
- In the high flood areas, there is a need to grow more and more plants to overcome the intensity of the floods and safe from land sliding.

- According to the analyses of the states where floods days are long, there is a need to shift these peoples to other safe locations until the floods overcome or completely end.
- Make food, house and land arrangements for the peoples who are affected due to floods.
- The states where human and animal fatalities are increased need proper care and intention from the government side.
- NGOs in India must need to take part to provide facilities to the peoples of flood-affected areas.
- Provide the medical facilities to the states of floods where human and animal injuries are encountered to overcome death rates.
- Based on the forecast the pre-arrangements are necessary before floods happened.

Conclusion

The floods prediction in India is one of the really important projects because this contains human and animal lives with economic disorder. The data is collected from Indian online websites, and then a data cleaning process is performed to ready the data. The project is developed using the Power BI dashboard to predict floods in India. The project enhances the actual rations and provides an effective communication mechanism for the predictions of floods. We successfully developed the dashboard product to effectively visualize all the user stories after fulfilled the user stories acceptance criteria. The product was successfully tested and handed over to the client after fixing all the errors found during the testing process.

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